

Rexroth 1MB Frameless Spindle Motors

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Edition 02

Project Planning Manual



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Validity The specified data is for product description purposes only and may not be deemed to be guaranteed unless expressly confirmed in the contract. All rights are reserved with respect to the content of this documentation and the availability of the product.

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1 Introduction to the Product

Rexroth 1MB liquid-cooled asynchronous frameless spindle motors are used as direct drives in motor spindles. The position of the motor between the main spindle bearings gives the motor spindle a high rigidity. As a result, the main spindle and the C axis can be operated with only one drive in lathes, for example.

1MB motors are used for turning, milling and grinding in machine tools, transfer lines, processing centers and special-purpose machines.

Fig. 1.1 shows the components of an AC main spindle drive with a frameless spindle motor.

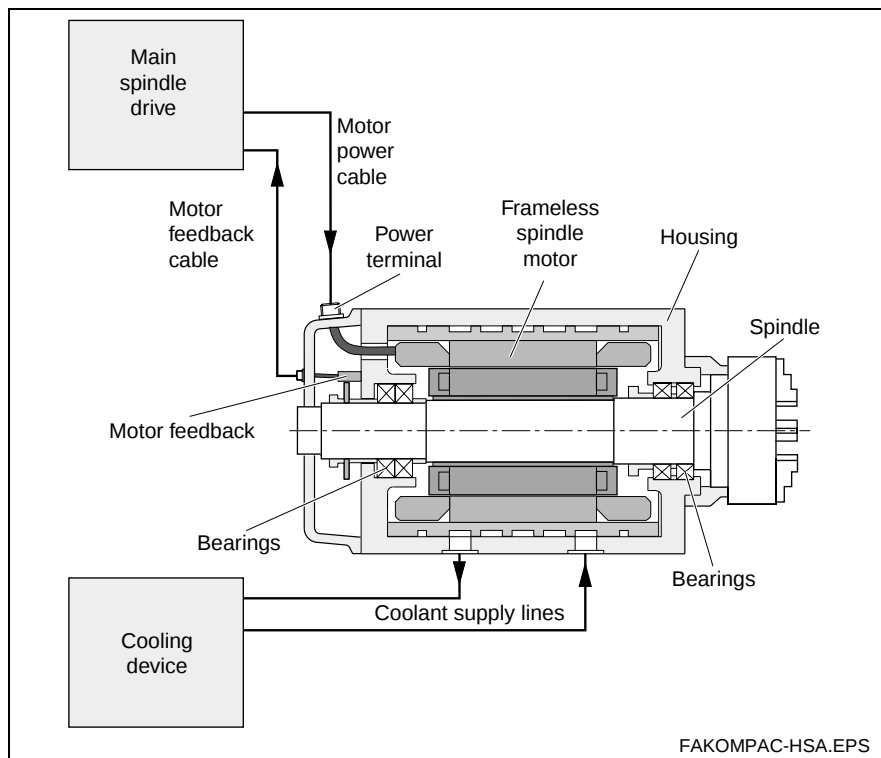


Fig. 1-1: Components of the 1MB AC main spindle drive with frameless spindle motor

The motor spindle consists of the functional units spindle with housing; bearings; frameless spindle motor with cooling; and motor feedback.

The specifications of the type of bearing, their lubrication, the degree of bearing priming, as well as the protection of the interior of the stator against dirt, coolant lubricants, bearing grease, etc. depends on the application of the motor spindle and is the responsibility of the spindle constructor.

Influences of the frameless spindle motor functional unit on the construction of the motor spindle are described in this documentation.

Motor feedback

The motor feedback measures the rotor position and reports it to the control device responsible for regulating the speed and position of the spindle. It is integrated in the motor spindle as an independent module.

Control device In combination with a Bosch Rexroth main spindle control device, the motor spindle provides a mechanical performance/torque according to the operating characteristics of the motor-control device combination. See the documentation "AC main spindle drives with controlled 1MB frameless spindle motor – selection data", Mat. No. R911262462.

Fig. 1-2 shows a typical operating characteristic curve.

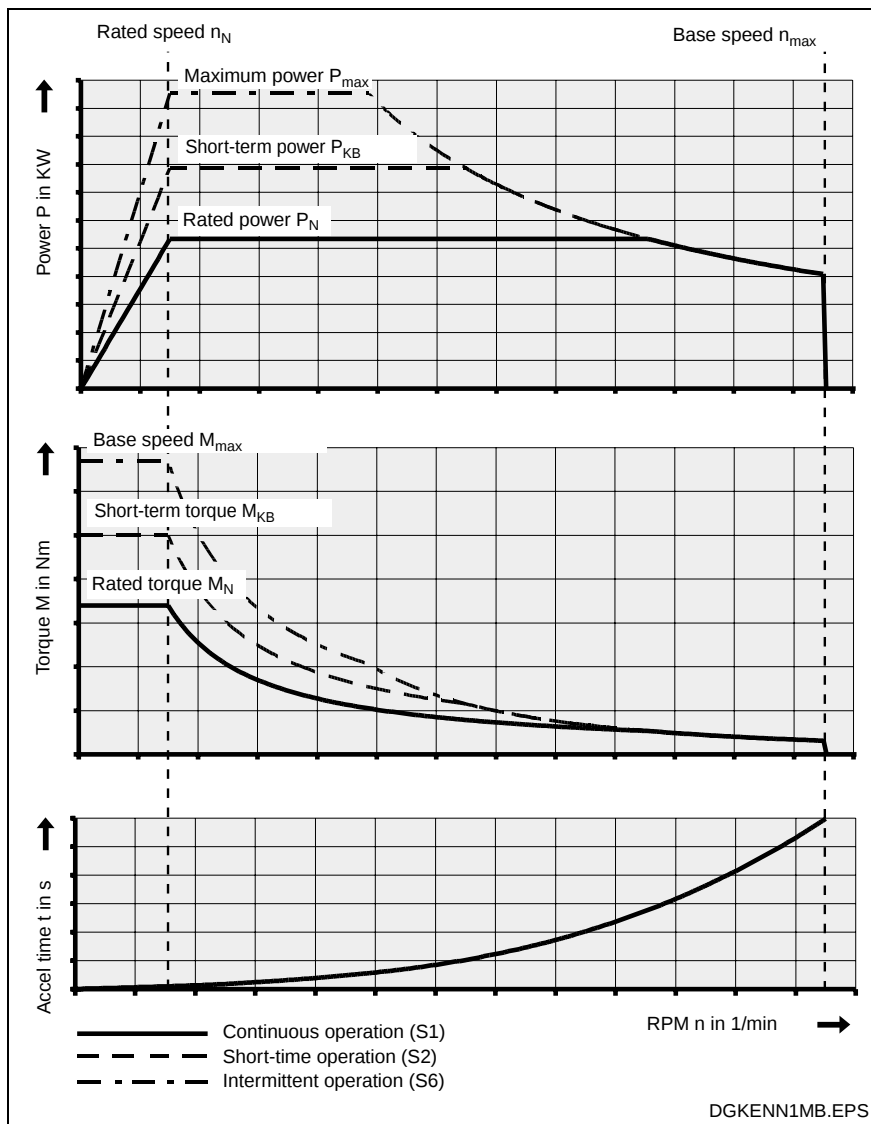


Fig. 1-2: Typical operating characteristic curve for the 1MB frameless spindle motor

Cooler Due to the liquid-cooled stator, the frameless spindle motor has a high power density. The coolant fluid absorbs the power loss of the stator and the major portion of the rotor power loss. The power loss is transferred to a superordinate coolant in the refrigeration unit.

Size and power graduation

The rated output of 1MB motors depending on the size is shown in the following diagram. This shows that a high rated output can be achieved even with a small size.

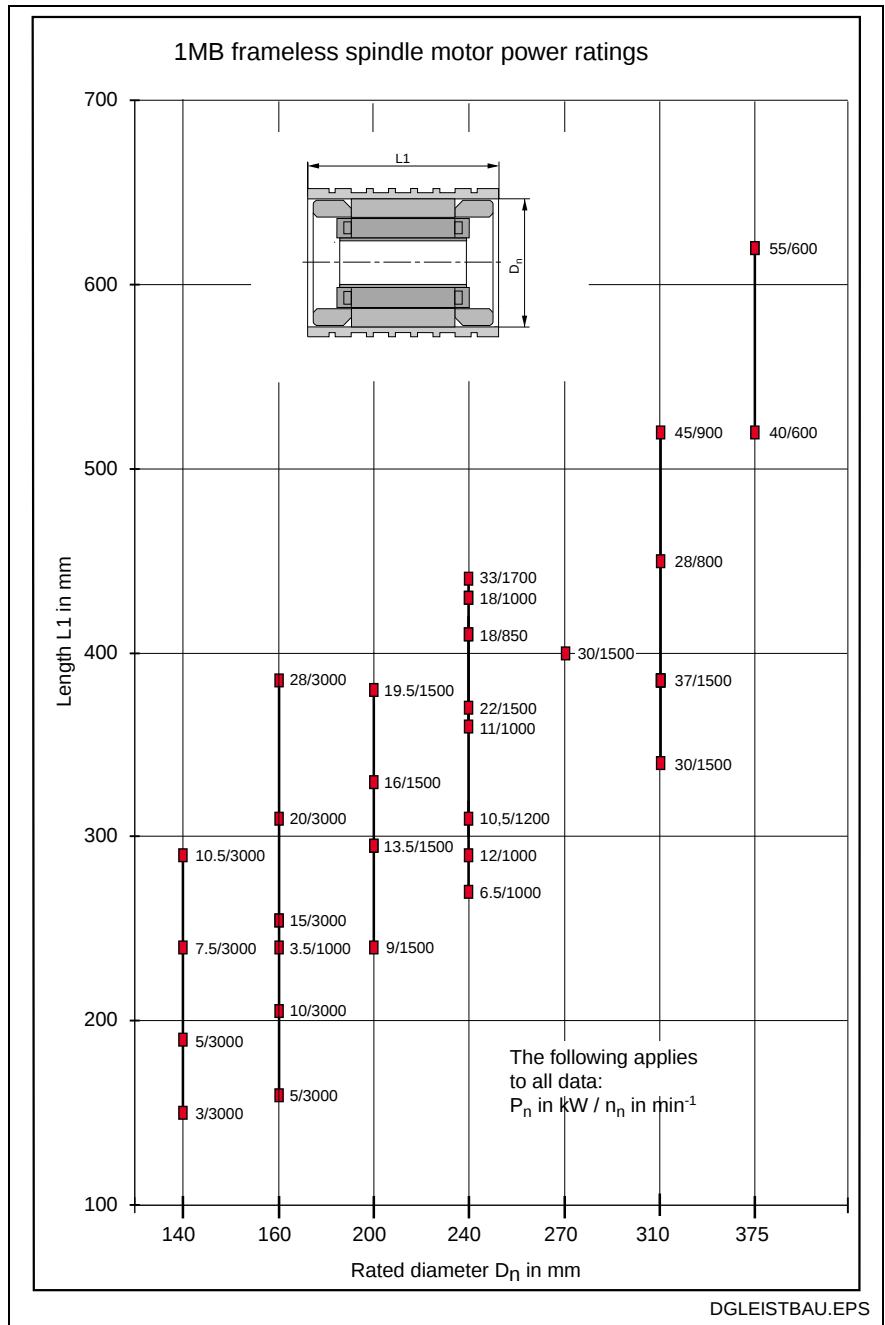


Fig. 1-3: Size and power graduation

1.1 About this Documentation

Document Structure

This documentation includes safety instructions, technical data and operating instructions. The following setup provides an overview of the contents of this documentation.

Sect.	Title		
1	Introduction	Introduction to the product and notes	
2	Important Instructions on Use	Important safety instructions	
3	Safety		
4	Technical Data	Product description	for planners and projectors
5	Dimension Sheets		
6	Type Code		
7	Accessories	Practice	for Operating and maintenance personnel
8	Connection System		
9	Notes regarding Application		
10	Handling & Transport		
11	Installation/Assembly Instructions		
12	Operation		
13	Service & Support		
14	Index	Additional information	

Fig. 1-4: Chapter structure

Modifications

In this edition, all the sections of the previous edition (209-0042-4124-01 EN /12.95) have been modified.

Additional Documentation

To project the drive-systems of the IndraDyn A motor type series, you may need additional documentation depending on the devices used in your case. Rexroth provides all product documentation on CD in a PDF-format. To project a system, you will not need all the documentations included on the CD.

Note: All documentations on the CD are also available in a printed version. You can order the required product documentations via your Rexroth sales office.

Material No.:	Title / description
R911281882	Product Documentation for Electric Drives and Controls Version xx ¹⁾ DOK-GENRL-CONTR*DRIVE-GNxx-DE-D650
R911281883	Product Documentation for Electric Drives and Controls Version xx ¹⁾ DOK-GENRL-CONTR*DRIVE-GNxx-EN-D650
1) The index (e.g. ... 02 ...) identifies the version of the documentation.	

Fig. 1-5: Additional documentation

Standards

This documentation refers to German, European and international technical standards. Documents and sheets on standards are subject to the protection by copyright and may not be passed on to third parties by REXROTH. If necessary, please address the authorized sales outlets or, in Germany, directly to:

BEUTH Verlag GmbH
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Additional Components

Documentations for external systems which are connected to BOSCH REXROTH components are not included in the scope of delivery and must be ordered directly from the particular manufacturers.

Feedback

Your experiences are an essential part of the process of improving both the product and the documentation.

Please do not hesitate to inform us of any mistakes you detect in this documentation or of any modifications you might desire. We would appreciate your feedback.

Please send your remarks to:

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2 Important directions for use

2.1 Appropriate use

Introduction

Bosch Rexroth products represent state-of-the-art developments and manufacturing. They are tested prior to delivery to ensure operating safety and reliability.

The products may only be used in the manner that is defined as appropriate. If they are used in an inappropriate manner, then situations can develop that may lead to property damage or injury to personnel.

Note: Bosch Rexroth, as manufacturer, is not liable for any damages resulting from inappropriate use. In such cases, the guarantee and the right to payment of damages resulting from inappropriate use are forfeited. The user alone carries all responsibility of the risks.

Before using Rexroth products, make sure that all the pre-requisites for appropriate use of the products are satisfied:

- Personnel that in any way, shape or form uses our products must first read and understand the relevant safety instructions and be familiar with appropriate use.
- If the product takes the form of hardware, then they must remain in their original state, in other words, no structural changes are permitted. It is not permitted to decompile software products or alter source codes.
- Do not mount damaged or faulty products or use them in operation.
- Make sure that the products have been installed in the manner described in the relevant documentation.

Areas of use and application

Frameless spindle motors of the 1MB series from Bosch Rexroth are intended to be used as direct drives in motor spindles.

Control and monitoring of the 1MB frameless spindle motor may require additional sensors and actors.

Drive controller types with different drive power and different interfaces are available for the application-related utilization of the motors.

Note: The 1MB frameless spindle motors may only be used with the accessories and parts specified in this document. If a component has not been specifically named, then it may not be either mounted or connected. The same applies to cables and lines.

Operation is only permitted in the specified configurations and combinations of components using the software and firmware as specified in the relevant function descriptions.

Every drive controller has to be programmed before starting it up, making it possible for the motor to execute the specific functions of an application.

The motors may only be operated under the assembly, installation and ambient conditions as described here (temperature, system of protection, humidity, EMC requirements, etc.) and in the position specified.

2.2 Inappropriate use

Using the 1MB frameless spindle motor outside of the above-referenced areas of application or under operating conditions other than described in the document and the technical data specified is defined as "inappropriate use".

1MB frameless spindle motors may not be used if

- they are subject to operating conditions that do not meet the above specified ambient conditions. This includes, for example, operation under water, in the case of extreme temperature fluctuations or extremely high maximum temperatures or if
- Bosch Rexroth has not specifically released them for that intended purpose. Please note the specifications outlined in the general Safety Guidelines!

3 Safety Instructions for Electric Drives and Controls

3.1 Introduction

Read these instructions before the initial startup of the equipment in order to eliminate the risk of bodily harm or material damage. Follow these safety instructions at all times.

Do not attempt to install or start up this equipment without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation of the equipment prior to working with the equipment at any time. If you do not have the user documentation for your equipment, contact your local Bosch Rexroth representative to send this documentation immediately to the person or persons responsible for the safe operation of this equipment.

If the equipment is resold, rented or transferred or passed on to others, then these safety instructions must be delivered with the equipment.



WARNING

Improper use of this equipment, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, may result in material damage, bodily harm, electric shock or even death!

3.2 Explanations

The safety instructions describe the following degrees of hazard seriousness in compliance with ANSI Z535. The degree of hazard seriousness informs about the consequences resulting from non-compliance with the safety instructions.

Warning symbol with signal word	Degree of hazard seriousness according to ANSI
 DANGER	Death or severe bodily harm will occur.
 WARNING	Death or severe bodily harm may occur.
 CAUTION	Bodily harm or material damage may occur.

Fig. 3-1: Hazard classification (according to ANSI Z535)

3.3 Hazards by Improper Use



DANGER

**High voltage and high discharge current!
Danger to life or severe bodily harm by electric shock!**



DANGER

Dangerous movements! Danger to life, severe bodily harm or material damage by unintentional motor movements!



WARNING

High electrical voltage due to wrong connections! Danger to life or bodily harm by electric shock!



WARNING

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!



CAUTION

Surface of machine housing could be extremely hot! Danger of injury! Danger of burns!



CAUTION

Risk of injury due to improper handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock or incorrect handling of pressurized systems!



CAUTION

Risk of injury due to incorrect handling of batteries!

3.4 General Information

- Bosch Rexroth AG is not liable for damages resulting from failure to observe the warnings provided in this documentation.
- Read the operating, maintenance and safety instructions in your language before starting up the machine. If you find that you cannot completely understand the documentation for your product, please ask your supplier to clarify.
- Proper and correct transport, storage, assembly and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this equipment.
- Only persons who are trained and qualified for the use and operation of the equipment may work on this equipment or within its proximity.
 - The persons are qualified if they have sufficient knowledge of the assembly, installation and operation of the equipment as well as an understanding of all warnings and precautionary measures noted in these instructions.
 - Furthermore, they must be trained, instructed and qualified to switch electrical circuits and equipment on and off in accordance with technical safety regulations, to ground them and to mark them according to the requirements of safe work practices. They must have adequate safety equipment and be trained in first aid.
- Only use spare parts and accessories approved by the manufacturer.
- Follow all safety regulations and requirements for the specific application as practiced in the country of use.
- The equipment is designed for installation in industrial machinery.
- The ambient conditions given in the product documentation must be observed.
- Use only safety features and applications that are clearly and explicitly approved in the Project Planning Manual.

For example, the following areas of use are not permitted: construction cranes, elevators used for people or freight, devices and vehicles to transport people, medical applications, refinery plants, transport of hazardous goods, nuclear applications, applications sensitive to high frequency, mining, food processing, control of protection equipment (also in a machine).
- The information given in the documentation of the product with regard to the use of the delivered components contains only examples of applications and suggestions.

The machine and installation manufacturer must

 - make sure that the delivered components are suited for his individual application and check the information given in this documentation with regard to the use of the components,
 - make sure that his application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.
- Startup of the delivered components is only permitted once it is sure that the machine or installation in which they are installed complies with the national regulations, safety specifications and standards of the application.

- Operation is only permitted if the national EMC regulations for the application are met.
The instructions for installation in accordance with EMC requirements can be found in the documentation "EMC in Drive and Control Systems".
The machine or installation manufacturer is responsible for compliance with the limiting values as prescribed in the national regulations.
- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

3.5 Protection Against Contact with Electrical Parts

Note: This section refers to equipment and drive components with voltages above 50 Volts.

Touching live parts with voltages of 50 Volts and more with bare hands or conductive tools or touching ungrounded housings can be dangerous and cause electric shock. In order to operate electrical equipment, certain parts must unavoidably have dangerous voltages applied to them.



DANGER

High electrical voltage! Danger to life, severe bodily harm by electric shock!

- = Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain or repair this equipment.
 - = Follow general construction and safety regulations when working on high voltage installations.
 - = Before switching on power the ground wire must be permanently connected to all electrical units according to the connection diagram.
 - = Do not operate electrical equipment at any time, even for brief measurements or tests, if the ground wire is not permanently connected to the points of the components provided for this purpose.
 - = Before working with electrical parts with voltage higher than 50 V, the equipment must be disconnected from the mains voltage or power supply. Make sure the equipment cannot be switched on again unintended.
 - = The following should be observed with electrical drive and filter components:
 - = Wait five (5) minutes after switching off power to allow capacitors to discharge before beginning to work. Measure the voltage on the capacitors before beginning to work to make sure that the equipment is safe to touch.
 - = Never touch the electrical connection points of a component while power is turned on.
 - = Install the covers and guards provided with the equipment properly before switching the equipment on. Prevent contact with live parts at any time.
 - = A residual-current-operated protective device (RCD) must not be used on electric drives! Indirect contact must be prevented by other means, for example, by an overcurrent protective device.
 - = Electrical components with exposed live parts and uncovered high voltage terminals must be installed in a protective housing, for example, in a control cabinet.
-

To be observed with electrical drive and filter components:



DANGER

**High electrical voltage on the housing!
High leakage current! Danger to life, danger of
injury by electric shock!**

- = Connect the electrical equipment, the housings of all electrical units and motors permanently with the safety conductor at the ground points before power is switched on. Look at the connection diagram. This is even necessary for brief tests.
- = Connect the safety conductor of the electrical equipment always permanently and firmly to the supply mains. Leakage current exceeds 3.5 mA in normal operation.
- = Use a copper conductor with at least 10 mm² cross section over its entire course for this safety conductor connection!
- = Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. Otherwise, high voltages can occur on the housing that lead to electric shock.

3.6 Protection Against Electric Shock by Protective Low Voltage (PELV)

All connections and terminals with voltages between 0 and 50 Volts on Rexroth products are protective low voltages designed in accordance with international standards on electrical safety.



WARNING

**High electrical voltage due to wrong
connections! Danger to life, bodily harm by
electric shock!**

- = Only connect equipment, electrical components and cables of the protective low voltage type (PELV = Protective Extra Low Voltage) to all terminals and clamps with voltages of 0 to 50 Volts.
- = Only electrical circuits may be connected which are safely isolated against high voltage circuits. Safe isolation is achieved, for example, with an isolating transformer, an opto-electronic coupler or when battery-operated.

3.7 Protection Against Dangerous Movements

Dangerous movements can be caused by faulty control of the connected motors. Some common examples are:

- improper or wrong wiring of cable connections
- incorrect operation of the equipment components
- wrong input of parameters before operation
- malfunction of sensors, encoders and monitoring devices
- defective components
- software or firmware errors

Dangerous movements can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

The monitoring in the drive components will normally be sufficient to avoid faulty operation in the connected drives. Regarding personal safety, especially the danger of bodily injury and material damage, this alone cannot be relied upon to ensure complete safety. Until the integrated monitoring functions become effective, it must be assumed in any case that faulty drive movements will occur. The extent of faulty drive movements depends upon the type of control and the state of operation.

**DANGER****Dangerous movements! Danger to life, risk of injury, severe bodily harm or material damage!**

- = Ensure personal safety by means of qualified and tested higher-level monitoring devices or measures integrated in the installation. Unintended machine motion is possible if monitoring devices are disabled, bypassed or not activated.
- = Pay attention to unintended machine motion or other malfunction in any mode of operation.
- = Keep free and clear of the machine's range of motion and moving parts. Possible measures to prevent people from accidentally entering the machine's range of motion:
 - use safety fences
 - use safety guards
 - use protective coverings
 - install light curtains or light barriers
- = Fences and coverings must be strong enough to resist maximum possible momentum, especially if there is a possibility of loose parts flying off.
- = Mount the emergency stop switch in the immediate reach of the operator. Verify that the emergency stop works before startup. Don't operate the machine if the emergency stop is not working.
- = Isolate the drive power connection by means of an emergency stop circuit or use a starting lockout to prevent unintentional start.
- = Make sure that the drives are brought to a safe standstill before accessing or entering the danger zone. Safe standstill can be achieved by switching off the power supply contactor or by safe mechanical locking of moving parts.
- = Secure vertical axes against falling or dropping after switching off the motor power by, for example:
 - mechanically securing the vertical axes
 - adding an external braking/ arrester/ clamping mechanism
 - ensuring sufficient equilibration of the vertical axes

The standard equipment motor brake or an external brake controlled directly by the drive controller are not sufficient to guarantee personal safety!

- = Disconnect electrical power to the equipment using a master switch and secure the switch against reconnection for:
 - maintenance and repair work
 - cleaning of equipment
 - long periods of discontinued equipment use
 - = Prevent the operation of high-frequency, remote control and radio equipment near electronics circuits and supply leads. If the use of such equipment cannot be avoided, verify the system and the installation for possible malfunctions in all possible positions of normal use before initial startup. If necessary, perform a special electromagnetic compatibility (EMC) test on the installation.
-

3.8 Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated near current-carrying conductors and permanent magnets in motors represent a serious health hazard to persons with heart pacemakers, metal implants and hearing aids.



WARNING

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!

- = Persons with heart pacemakers, hearing aids and metal implants are not permitted to enter the following areas:
 - Areas in which electrical equipment and parts are mounted, being operated or started up.
 - Areas in which parts of motors with permanent magnets are being stored, operated, repaired or mounted.
 - = If it is necessary for a person with a heart pacemaker to enter such an area, then a doctor must be consulted prior to doing so. Heart pacemakers that are already implanted or will be implanted in the future, have a considerable variation in their electrical noise immunity. Therefore there are no rules with general validity.
 - = Persons with hearing aids, metal implants or metal pieces must consult a doctor before they enter the areas described above. Otherwise, health hazards will occur.
-

3.9 Protection Against Contact with Hot Parts



CAUTION

**Housing surfaces could be extremely hot!
Danger of injury! Danger of burns!**

- = Do not touch housing surfaces near sources of heat! Danger of burns!
- ⇒ After switching the equipment off, wait at least ten (10) minutes to allow it to cool down before touching it.
- = Do not touch hot parts of the equipment, such as housings with integrated heat sinks and resistors. Danger of burns!

3.10 Protection During Handling and Mounting

Under certain conditions, incorrect handling and mounting of parts and components may cause injuries.



CAUTION

Risk of injury by incorrect handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock!

- = Observe general installation and safety instructions with regard to handling and mounting.
- ⇒ Use appropriate mounting and transport equipment.
- ⇒ Take precautions to avoid pinching and crushing.
- = Use only appropriate tools. If specified by the product documentation, special tools must be used.
- ⇒ Use lifting devices and tools correctly and safely.
- = For safe protection wear appropriate protective clothing, e.g. safety glasses, safety shoes and safety gloves.
- ⇒ Never stand under suspended loads.
- = Clean up liquids from the floor immediately to prevent slipping.

3.11 Battery Safety

Batteries contain reactive chemicals in a solid housing. Inappropriate handling may result in injuries or material damage.



CAUTION

Risk of injury by incorrect handling!

- = Do not attempt to reactivate discharged batteries by heating or other methods (danger of explosion and cauterization).
- = Never charge non-chargeable batteries (danger of leakage and explosion).
- ⇒ Never throw batteries into a fire.
- ⇒ Do not dismantle batteries.
- = Do not damage electrical components installed in the equipment.

Note: Be aware of environmental protection and disposal! The batteries contained in the product should be considered as hazardous material for land, air and sea transport in the sense of the legal requirements (danger of explosion). Dispose batteries separately from other waste. Observe the legal requirements in the country of installation.

3.12 Protection Against Pressurized Systems

Certain motors and drive controllers, corresponding to the information in the respective Project Planning Manual, must be provided with pressurized media, such as compressed air, hydraulic oil, cooling fluid and cooling lubricant supplied by external systems. Incorrect handling of the supply and connections of pressurized systems can lead to injuries or accidents. In these cases, improper handling of external supply systems, supply lines or connections can cause injuries or material damage.



CAUTION

Danger of injury by incorrect handling of pressurized systems !

- = Do not attempt to disassemble, to open or to cut a pressurized system (danger of explosion).
- = Observe the operation instructions of the respective manufacturer.
- = Before disassembling pressurized systems, release pressure and drain off the fluid or gas.
- = Use suitable protective clothing (for example safety glasses, safety shoes and safety gloves)
- = Remove any fluid that has leaked out onto the floor immediately.

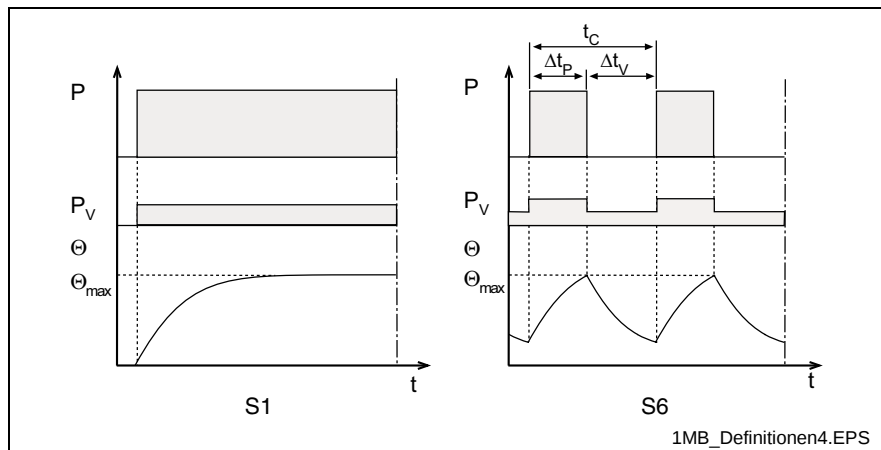
Note: Environmental protection and disposal! The media used in the operation of the pressurized system equipment may not be environmentally compatible. Media that are damaging the environment must be disposed separately from normal waste. Observe the legal requirements in the country of installation.

Notes

4 Technical Data

4.1 Operating Modes

Bosch Rexroth motors are documented according to the test criteria and measuring methods of EN 60034-1. Stated technical data refer to the operating mode S1 (continuous operation) and S6 (periodic operation), each with liquid cooling and with water as the coolant.



P:	Load
P _V :	Electric losses
Θ	Temperature
Θ _{max} :	Highest temperature (stator)
t:	Time
t _c :	Cycle duration
Δt _p :	Operating time with constant load
Δt _v :	Idle time

Fig. 4-1: Operating modes according to EN 60034-1: 1998

ON Time

Operating mode S6 is supplemented by specification of the ON time (ED) in %. The ON time is calculated with the following formula:

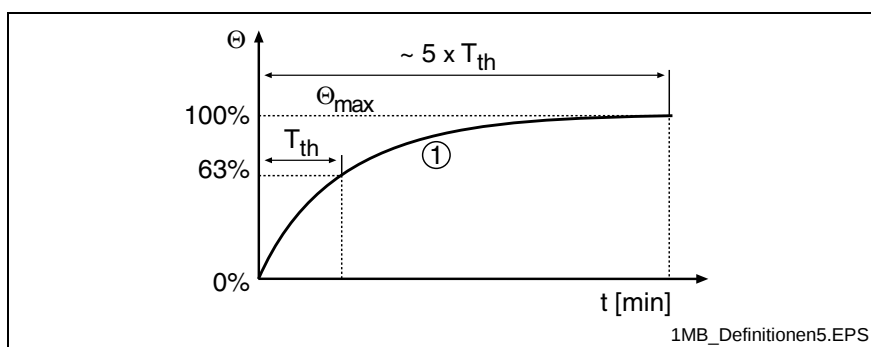
$$ED = \frac{\Delta t_p}{t_c} \cdot 100\%$$

ED:	Cyclic duration factor in %
t _c :	Cycle duration
Δt _p :	Operating time with constant load

Fig. 4-2: Cyclic duration factor

4.2 Parameters

Rated torque M_N	Available torque that can be output at the rated speed in operating mode S1. Unit: Newton-meter (Nm).
Rated speed n_N	Typical working speed defined by the manufacturer. Depending on the particular application, other working speeds are possible (see speed-torque curve).
Rated output P_N	Power consumption of the motor at the rated speed and load with rated torque, specified in kilowatts (kW).
Rated current I_N	Phase current of the motor at the rated speed and load with rated torque, specified as a root-mean-square value in ampere (A).
Nominal voltage U_{eff}	Voltage of the motor at the rated speed and rated current, measured between 2 phases, specified as a root-mean-square value in volts (V).
Peak current I_{max}	Peak current (root-mean-square) of the motor at M_{max} . Unit: amperes (A).
Moment of inertia of the rotor J_M	The moment of inertia of the rotor without bearing and encoder. Unit: kgm^2 .
Inductivity L	Inductivity of the motor, measured between 2 phases. Unit: milliHenry (mH).
Torque constant at 20°C K_M	Relation of the torque increase to the motor phase current (root-mean-square). Unit: Nm/A. Valid up to the rated current I_N .
Stator/rotor mass m	Mass of stator and rotor, without bearing and encoder, specified in kilograms (kg).
Maximum speed n_{max}	Maximum allowed speed of the motor in rpm. Normally restricted by mechanical factors such as centrifugal force or bearing load.
Thermal time constant T_{th}	Duration of the temperature rise to 63% of the final temperature of the stators under load with rated torque in S1 operation and liquid cooling.

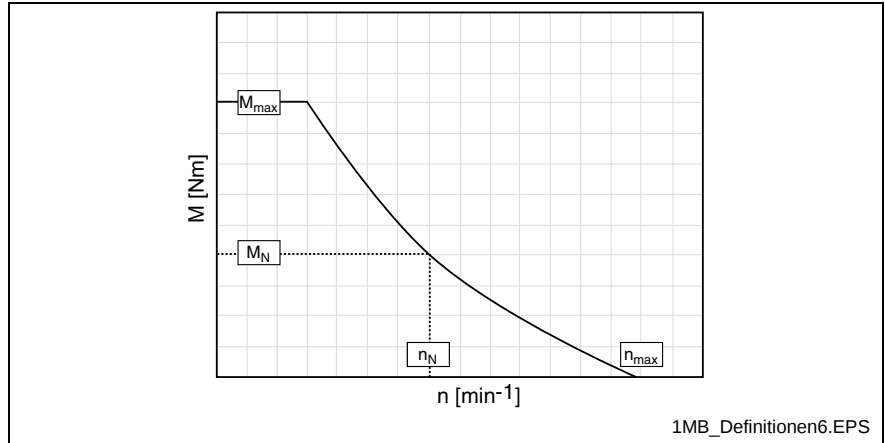


(1): Course of the stator temperature over time
 T_{th} : Thermal time constant

Fig. 4-3: Thermal time constant

4.3 Operating Characteristics

The following sample characteristic curve provides an example of the operating behavior of 1MB motors, as does information found in the motor data sheet.



M_{max} : Maximum torque
 M_N : Rated torque
 n_N : Rated speed
 n_{max} : Maximum speed

Fig. 4-4: 1MB sample characteristic curve

4.4 Technical Data for 1MB140

Description		Symbol	Unit	1MB140				
Motor data ¹⁾								
Frame length				B		D	F	H
Winding code				4A	4B	4B	4A	4B
Rated torque		M _N	Nm	7		14	24	34
Rated speed		n _N	rpm	7500	5000	4000	3000	
Rated power		P _N	kW	5.5	3.7	6	7.5	10.5
Rated current		I _N	A	18	25	43	43	58
Nominal voltage		U _{neff}	V	400	166	157	182	174
Max. voltage		I _{max}	A	41.8	52.7	89.4	111.3	127.3
Maximum speed		n _{max}	rpm	20000		16000	15000	
Min. cross-section of power connector ²⁾		A	mm ²	2.5	4	10	10	16
Moment of inertia of the rotor		J _m	kgm ²	0.0044		0.0061	0.0082	0.0103
Winding resistance		R	Ω	0.423	0.147	0.2	0.21	0.198
Inductivity ³⁾		L	mH	2.93	2.85	1.74	1.83	1.58
Constant torque at 20°C		K _m	Nm/A	4.24	0.34	0.4	0.54	0.59
Mass	Stator	m _S	kg	5.3		8.2	11.8	15.5
	Rotor	m _R	kg	3.3		4.5	6.1	7.3
Number of pole pairs		p		2				
Thermal time constant		t _{th}	min	i.p.				
Permissible ambient temperature		t _U	°C	0...40				
Permissible storage and transport temperature		t _L	°C	-20...+80				
Insulation class acc. to DIN VDE 0530-1				F				
Class of motor protection				IP00				

Liquid cooling								
Rated power loss		P _{VN}	kW	1		1.6	2.4	3.2
Liquid cooling temperature at inlet		ϑ _{in}	°C	10...40				
Temperature rise at P _{VN} ⁴⁾		Δϑ _N	K	10				
Required liquid cooling flow at Δϑ _N ⁴⁾		Q _N	l/min	1.4		2.3	3.4	4.6
Decompression at Q _N		Δp	bar	0.1				
Permissible inlet pressure		p _{max}	bar	3				
Volume liquid cooling duct		V	l	0.2		0.3	0.4	0.6

¹⁾ The determined values are root-mean-square according to IEC 60034-1, if no others are given. Reference value 540 V_{DC} intermediate circuit voltage.

²⁾ Measured according to EN60204-1 (1993), installation mode B2 and conversion factor for Rexroth cables at 40°C ambient temperature. When using other cables, larger cross-sections may be required.

³⁾ Inductivity of the mounted motor spindle at 20°C. Measurement between two phases with f_L = 1kHz.

⁴⁾ The data refer to operation with liquid cooling (cooling medium is water).

Fig. 4-5: Technical data for 1MB140

4.5 Technical Data for 1MB160

Description	Symbol	Unit	1MB160						
Motor data ¹⁾									
Frame length			B	D		E	F		
Winding code			4A	4A	4B	4B	4A	4B	4D
Rated torque	M _N	Nm	16	32		33	48		
Rated speed	n _N	rpm	3000		2000	1000	3000		2500
Rated power	P _N	kW	5	10	6.7	3.5	15	15	12.5
Rated current	I _N	A	36	48	23.8	19	74	45	23.2
Nominal voltage	U _{neff}	V	138	171	370	176	520	285	440
Max. voltage	I _{max}	A	78.4	112.8	53.3	34.8	169.4	99.9	54.1
Maximum speed	n _{max}	rpm	12000		8000	4000	12000		10000
Min. cross-section of power connector ²⁾	A	mm ²	6	10	4	2.5	25	10	4
Moment of inertia of the rotor	J _m	kgm ²	0.008	0.012		0.015	0.016		
Winding resistance	R	Ω	0.264	0.182	0.775	1.113	0.106	0.3	0.96
Inductivity ³⁾	L	mH	1.31	1.57	7.23	8	0.71	2.01	7.32
Constant torque at 20°C	K _m	Nm/A	0.52	0.72	1.38	2.43	0.72	1.22	2.25
Mass	Stator	m _S	kg	6.8	11.1	14.4	15.8		
	Rotor	m _R	kg	5.3	7.3	9.4	10.2		
Number of pole pairs	p		2						
Thermal time constant	t _{th}	min	i.p.						
Permissible ambient temperature	t _U	°C	0...40						
Permissible storage and transport temperature	t _L	°C	-20...+80						
Insulation class acc. to DIN VDE 0530-1			F						
Class of motor protection			IP00						

Liquid cooling									
Rated power loss	P _{VN}	kW	1.2	1.8		2.1	3		
Liquid cooling temperature at inlet	ϑ _{in}	°C	10...40						
Temperature rise at P _{VN} ⁴⁾	Δϑ _N	K	10						
Required liquid cooling flow at Δϑ _N ⁴⁾	Q _N	l/min	1.7	2.6		3	4.3		
Decompression at Q _N	Δp	bar	0.1						
Permissible inlet pressure	p _{max}	bar	3						
Volume liquid cooling duct	V	l	0.2	0.3		0.5			

¹⁾ The determined values are root-mean-square according to IEC 60034-1, if no others are given. Reference value 540 V_{DC} intermediate circuit voltage.

²⁾ Measured according to EN60204-1 (1993), installation mode B2 and conversion factor for Rexroth cables at 40°C ambient temperature. When using other cables, larger cross-sections may be required.

³⁾ Inductivity of the mounted motor spindle at 20°C. Measurement between two phases with f_L = 1kHz.

⁴⁾ The data refer to operation with liquid cooling (cooling medium is water).

Fig. 4-6: 1MB160 data sheet (1/2)

Description		Symbol	Unit	1MB160			
Motor data ¹⁾							
Frame length			H	N			
Winding code			4A	4A	4B	4C	
Rated torque		M _N	Nm	64	89		
Rated speed		n _N	rpm	3000	3000	1000	1500
Rated power		P _N	kW	20	28	9.3	14
Rated current		I _N	A	58	75	60	26
Nominal voltage		U _{neff}	V	281	303	400	464
Max. voltage		I _{max}	A	132.2	170.8	135.5	67.8
Maximum speed		n _{max}	rpm	12000	12000	4000	6000
Min. cross-section of power connector ²⁾		A	mm ²	16	25	16	4
Moment of inertia of the rotor		J _m	kgm ²	0.02	0.027		
Winding resistance		R	Ω	0.2	0.147	0.242	1.1
Inductivity ³⁾		L	mH	1.79	1.37	2.2	9.45
Constant torque at 20°C		K _m	Nm/A	1.23	1.31	1.67	3.34
Mass	Stator	m _S	kg	21	28.1	28.1	28.1
	Rotor	m _R	kg	9.8	12.7	12.7	12.7
Number of pole pairs		p		2			
Thermal time constant		t _{th}	min	i.p.			
Permissible ambient temperature		t _U	°C	0...40			
Permissible storage and transport temperature		t _L	°C	-20...+80			
Insulation class acc. to DIN VDE 0530-1				F			
Class of motor protection				IP00			

Liquid cooling						
Rated power loss	P _{VN}	kW	3.8	4.8	3.3	3.6
Liquid cooling temperature at inlet	ϑ _{in}	°C	10...40			
Temperature rise at P _{VN}	Δϑ _N	K	10			
Required liquid cooling flow at Δϑ _N	Q _N	l/min	5.4	6.9	4.9	4.5
Decompression at Q _N	Δp	bar	0.2	0.3		
Permissible inlet pressure	p _{max}	bar	3			
Volume liquid cooling duct	V	l	0.7	0.9		
1) The determined values are root-mean-square according to IEC 60034-1, if no others are given. Reference value 540 V _{DC} intermediate circuit voltage.						
2) Measured according to EN60204-1 (1993), installation mode B2 and conversion factor for Rexroth cables at 40°C ambient temperature. When using other cables, larger cross-sections may be required.						
3) Inductivity of the mounted motor spindle at 20°C. Measurement between two phases with f _L = 1kHz.						
4) The data refer to operation with liquid cooling (cooling medium is water).						

Fig. 4-7: 1MB160 data sheet (2/2)

4.6 Technical Data for 1MB200

Description	Symbol	Unit	1MB200					
Motor data ¹⁾								
Frame length			C	D				
Winding code			4A	4B	4C	4D	4E	4F
Rated torque	M _N	Nm	57	85	59	85	85	49
Rated speed	n _N	rpm	1500	1500	5000	2500	1500	6000
Rated power	P _N	kW	9	13.5	31	22	13.5	31
Rated current	I _N	A	50	48	75	59	84	82
Nominal voltage	U _{neff}	V	164	240	350	260	138	320
Max. voltage	I _{max}	A	114.5	115.8	157.2	144.3	201.9	182.2
Maximum speed	n _{max}	rpm	6000	6000	20000	10000	6000	18000
Min. cross-section of power connector ²⁾	A	mm ²	10	10	25	16	25	25
Moment of inertia of the rotor	J _m	kgm ²	0.041	0.037				
Winding resistance	R	Ω	0.236	0.294	0.083	0.197	0.1	0.044
Inductivity ³⁾	L	mH	1.87	2.75	0.785	1.775	0.9	0.382
Constant torque at 20°C	K _m	Nm/A	1.26	1.85	0.96	1.48	1.06	0.69
Mass	Stator	m _S	21	29				
	Rotor	m _R	15	19				
Number of pole pairs	p		2					
Thermal time constant	t _{th}	min	i.p.					
Permissible ambient temperature	t _U	°C	0...40					
Permissible storage and transport temperature	t _L	°C	-20...+80					
Insulation class acc. to DIN VDE 0530-1			F					
Class of motor protection			IP00					

Liquid cooling								
Rated power loss	P_{VN}	kW	2	2.7	3	2.7	2.7	3.5
Liquid cooling temperature at inlet	ϑ_{in}	°C	10...40					
Temperature rise at P_{VN}	$\Delta\vartheta_N$	K	10					
Required liquid cooling flow at $\Delta\vartheta_N$	Q_N	l/min	2.9	3.9	4.3	4	3.9	6.3
Decompression at Q_N	Δp	bar	0.1					
Permissible inlet pressure	p_{max}	bar	3					
Volume liquid cooling duct	V	l	0.6	0.8				
¹⁾ The determined values are root-mean-square according to IEC 60034-1, if no others are given. Reference value 540 V _{DC} intermediate circuit voltage.								
²⁾ Measured according to EN60204-1 (1993), installation mode B2 and conversion factor for Rexroth cables at 40°C ambient temperature. When using other cables, larger cross-sections may be required.								
³⁾ Inductivity of the mounted motor spindle at 20°C. Measurement between two phases with f ₋ = 1kHz.								
⁴⁾ The data refer to operation with liquid cooling (cooling medium is water).								

Fig. 4-8: 1MB200 data sheet (1/2)

Description	Symbol	Unit	1MB200			
Motor data ¹⁾						
Frame length			E		H	
Winding code			4B	4C	4B	4D
Rated torque	M _N	Nm	85	74	124	124
Rated speed	n _N	rpm	1800	3900	1500	
Rated power	P _N	kW	16	30.2	19.5	19.5
Rated current	I _N	A	41.4	65	68	52.6
Nominal voltage	U _{neff}	V	312	400	238	320
Max. voltage	I _{max}	A	111.1	139.4	171	128.2
Maximum speed	n _{max}	rpm	7200	15600	6000	
Min. cross-section of power connector ²⁾	A	mm ²	10	16	16	10
Moment of inertia of the rotor	J _m	kgm ²	0.059	0.069		
Winding resistance	R	Ω	0.359	0.106	0.17	0.296
Inductivity ³⁾	L	mH	3.5	1	1.65	2.87
Constant torque at 20°C	K _m	Nm/A	2.32	1.37	1.82	2.43
Mass	Stator	m _S	kg	34		41
	Rotor	m _R	kg	22		26
Number of pole pairs	p		2			
Thermal time constant	t _{th}	min	i.p.			
Permissible ambient temperature	t _U	°C	0...40			
Permissible storage and transport temperature	t _L	°C	-20...+80			
Insulation class acc. to DIN VDE 0530-1			F			
Class of motor protection			IP00			

Liquid Cooling						
Rated power loss	P _{VN}	kW	2.9	3.3	3.8	3.1
Liquid cooling temperature at inlet	ϑ _{in}	°C	10...40			
Temperature rise at P _{VN}	Δϑ _N	K	10			
Required liquid cooling flow at Δϑ _N	Q _N	l/min	4.2	5.4	5.4	4.4
Decompression at Q _N	Δp	bar	0.1	0.2		
Permissible inlet pressure	p _{max}	bar	3			
Volume liquid cooling duct	V	l	0.9	1.1		
1) The determined values are root-mean-square according to IEC 60034-1, if no others are given. Reference value 540 V _{DC} intermediate circuit voltage.						
2) Measured according to EN60204-1 (1993), installation mode B2 and conversion factor for Rexroth cables at 40°C ambient temperature. When using other cables, larger cross-sections may be Required.						
3) Inductivity of the mounted motor spindle at 20°C. Measurement between two phases with f _L = 1kHz.						
4) The data refer to operation with liquid cooling (cooling medium is water).						

Fig. 4-9: 1MB200 data sheet (2/2)

4.7 Technical Data for 1MB240

Description		Symbol	Unit	1MB240		
Motor data ¹⁾						
Frame length				B	F	H
Winding code				4A	4A	4B
Rated torque		M _N	Nm	62	123	169
Rated speed		n _N	rpm	1000		
Rated power		P _N	kW	6.5	13	18
Rated current		I _N	A	46	74	56
Nominal voltage		U _{neff}	V	122	145	270
Max. voltage		I _{max}	A	101.1	164.2	124.2
Maximum speed		n _{max}	rpm	4000		
Min. cross-section of power connector ²⁾		A	mm ²	10	25	16
Moment of inertia of the rotor		J _m	kgm ²	0.078	0.12	0.153
Winding resistance		R	Ω	0.213	0.143	0.259
Inductivity ³⁾		L	mH	1.665	1.29	2.75
Constant torque at 20°C		K _m	Nm/A	1.57	1.91	3.46
Mass	Stator	m _S	kg	29	48	62
	Rotor	m _R	kg	19	29	37
Number of pole pairs		p		2		
Thermal time constant		t _{th}	min	i.p.		
Permissible ambient temperature		t _U	°C	0...40		
Permissible storage and transport temperature		t _L	°C	-20...+80		
Insulation class according to DIN VDE 0530-1				F		
Class of motor protection				IP00		

Liquid cooling						
Rated power loss		P _{VN}	kW	1.8	2.9	3.5
Liquid cooling temperature at inlet		ϑ _{in}	°C	10...40		
Temperature rise at P _{VN} ⁴⁾		Δϑ _N	K	10		
Required liquid cooling flow at Δϑ _N ⁴⁾		Q _N	l/min	2.6	4.2	5
Decompression at Q _N		Δp	bar	0.1		0.2
Permissible inlet pressure		p _{max}	bar	3		
Volume liquid cooling duct		V	l	0.6	1	1.4

¹⁾ The determined values are root-mean-square according to IEC 60034-1, if no others are given. Reference value 540 V_{DC} intermediate circuit voltage.

²⁾ Measured according to EN60204-1 (1993), installation mode B2 and conversion factor for Rexroth cables at 40°C ambient temperature. When using other cables, larger cross-sections may be required.

³⁾ Inductivity of the mounted motor spindle at 20°C. Measurement between two phases with f₋ = 1kHz.

⁴⁾ The data refer to operation with liquid cooling (cooling medium is water).

Fig. 4-10: 1MB240 data sheet

4.8 Technical Data for 1MB241

Description		Symbol	Unit	1MB241			
Motor data ¹⁾							
Frame length				D		H	
Winding code				6A	6C	6C	6D 6G
Rated torque		M _N	Nm	112		202	
Rated speed		n _N	rpm	1000		1800	850 800
Rated power		P _N	kW	12		32	18 16,9
Rated current		I _N	A	62	27	75.5	66.4 39.7
Nominal voltage		U _{neff}	V	166	366	400	400 400
Max. voltage		I _{max}	A	139.5	59.7	184.5	127.9 91.9
Maximum speed		n _{max}	rpm	4000		7200	3400 3200
Min. cross-section of power connector ²⁾		A	mm ²	16	4	25	16 10
Moment of inertia of the rotor		J _m	kgm ²	0.135		0.227	
Winding resistance		R	Ω	0.19	0.92	0.135	0.302 0.664
Inductivity ³⁾		L	mH	1.17	5.7	1	2.12 5.05
Constant torque at 20°C		K _m	Nm/A	2.05	4.82	2.81	4.06 6.51
Mass	Stator	m _S	kg	38		63	
	Rotor	m _R	kg	24		39	
Number of pole pairs		p		3			
Thermal time constant		t _{th}	min	i.p.			
Permissible ambient temperature		t _U	°C	0...40			
Permissible storage and transport temperature		t _L	°C	-20...+80			
Insulation class according to DIN VDE 0530-1				F			
Class of motor protection				IP00			

Liquid cooling							
Rated power loss		P _{VN}	kW	2		4.5	3 4
Liquid cooling temperature at inlet		ϑ _{in}	°C	10...40			
Temperature rise at P _{VN} ⁴⁾		Δϑ _N	K	10			
Required liquid cooling flow at Δϑ _N ⁴⁾		Q _N	l/min	2.9		6.7	4.3 6.1
Decompression at Q _N		Δp	bar	0.1			
Permissible inlet pressure		p _{max}	bar	3			
Volume liquid cooling duct		V	l	0.8		1.4	

¹⁾ The determined values are root-mean-square according to IEC 60034-1, if no others are given. Reference value 540 V_{DC} intermediate circuit voltage.

²⁾ Measured according to EN60204-1 (1993), installation mode B2 and conversion factor for Rexroth cables at 40°C ambient temperature. When using other cables, larger cross-sections may be required.

³⁾ Inductivity of the mounted motor spindle at 20°C. Measurement between two phases with f_~ = 1kHz.

⁴⁾ The data refer to operation with liquid cooling (cooling medium is water).

Fig. 4-11: 1MB241 data sheet

4.9 Technical Data for 1MB242

Description	Symbol	Unit	1MB242
Motor data ¹⁾			
Frame length			N
Winding code			4B
Rated torque	M_N	Nm	185
Rated speed	n_N	rpm	1700
Rated power	P_N	kW	33
Rated current	I_N	A	98
Nominal voltage	U_{neff}	V	282
Max. voltage	I_{max}	A	224.3
Maximum speed	n_{max}	rpm	6800
Min. cross-section of power connector ²⁾	A	mm ²	35
Moment of inertia of the rotor	J_m	kgm ²	0.135
Winding resistance	R	Ω	0.084
Inductivity ³⁾	L	mH	1.29
Constant torque at 20°C	K_m	Nm/A	2.11
Mass	Stator	m_S	kg
	Rotor	m_R	kg
Number of pole pairs	p		2
Thermal time constant	t_{th}	min	i.p.
Permissible ambient temperature	t_U	°C	0...40
Permissible storage and transport temperature	t_L	°C	-20...+80
Insulation class according to DIN VDE 0530-1			F
Class of motor protection			IP00
Liquid cooling			
Rated power loss	P_{VN}	kW	3
Liquid cooling temperature at inlet	ϑ_{in}	°C	10...40
Temperature rise at P_{VN} ⁴⁾	$\Delta\vartheta_N$	K	10
Required liquid cooling flow at $\Delta\vartheta_N$ ⁴⁾	Q_N	l/min	4.3
Decompression at Q_N	Δp	bar	0.1
Permissible inlet pressure	p_{max}	bar	3
Volume liquid cooling duct	V	l	1.6
¹⁾ The determined values are root-mean-square according to IEC 60034-1, if no others are given. Reference value 540 V _{DC} intermediate circuit voltage. ²⁾ Measured according to EN60204-1 (1993), installation mode B2 and conversion factor for Rexroth cables at 40°C ambient temperature. When using other cables, larger cross-sections may be required. ³⁾ Inductivity of the mounted motor spindle at 20°C. Measurement between two phases with $f_{\sim}$ = 1kHz. ⁴⁾ The data refer to operation with liquid cooling (cooling medium is water).			

Fig. 4-12: 1MB242 data sheet

4.10 Technical Data for 1MB270

Description	Symbol	Unit	1MB270
Motor data ¹⁾			
Frame length			C
Winding code			4B
Rated torque	M_N	Nm	190
Rated speed	n_N	rpm	1500
Rated power	P_N	kW	30
Rated current	I_N	A	96
Nominal voltage	U_{neff}	V	255
Max. voltage	I_{max}	A	228.5
Maximum speed	n_{max}	rpm	6000
Min. cross-section of power connector ²⁾	A	mm ²	35
Moment of inertia of the rotor	J_m	kgm ²	0.258
Winding resistance	R	Ω	0.099
Inductivity ³⁾	L	mH	1.25
Constant torque at 20°C	K_m	Nm/A	2.12
Mass	Stator	m_S	kg
	Rotor	m_R	kg
Number of pole pairs	p		2
Thermal time constant	t_{th}	min	i.p.
Permissible ambient temperature	t_U	°C	0...40
Permissible storage and transport temperature	t_L	°C	-20...+80
Insulation class according to DIN VDE 0530-1			F
Class of motor protection			IP00
Liquid Cooling			
Rated power loss	P_{VN}	kW	3.6
Liquid cooling temperature at inlet	ϑ_{in}	°C	10...40
Temperature rise at P_{VN} ⁴⁾	$\Delta\vartheta_N$	K	10
Required liquid cooling flow at $\Delta\vartheta_N$ ⁴⁾	Q_N	l/min	5.2
Decompression at Q_N	Δp	bar	0.2
Permissible inlet pressure	p_{max}	bar	3
Volume liquid cooling duct	V	l	1.5
¹⁾ The determined values are root-mean-square according to IEC 60034-1, if no others are given. Reference value 540 V _{DC} intermediate circuit voltage. ²⁾ Measured according to EN60204-1 (1993), installation mode B2 and conversion factor for Rexroth cables at 40°C ambient temperature. When using other cables, larger cross-sections may be required. ³⁾ Inductivity of the mounted motor spindle at 20°C. Measurement between two phases with $f_{\sim} = 1\text{kHz}$. ⁴⁾ The data refer to operation with liquid cooling (cooling medium is water).			

Fig. 4-13: 1MB270 data sheet

4.11 Technical Data for 1MB310

Description		Symbol	Unit	1MB310				
Motor data ¹⁾								
Frame length				B			D	F
Winding code				6B	6D	6E	6B	6A 6B
Rated torque		M _N	Nm	260			340	480
Rated speed		n _N	rpm	1000	700	440	800	400 900
Rated power		P _N	kW	27	19	12	28.5	20 35
Rated current		I _N	A	75	81	58	81	61 111
Nominal voltage		U _{neff}	V	300	275	392	299	292 335
Max. voltage		I _{max}	A	164	179.9	125.7	174.2	138.7 246.7
Maximum speed		n _{max}	rpm	4000	2800	1760	3200	1600 3600
Min. cross-section of power connector ²⁾		A	mm ²	25	25	16	25	16 35
Moment of inertia of the rotor		J _m	kgm ²	0.477			0.492	0.723
Winding resistance		R	Ω	0.174	0.145	0.27	0.163	0.38 0.12
Inductivity ³⁾		L	mH	1.71	1.39	2.9	1.85	4.62 1.45
Constant torque at 20°C		K _m	Nm/A	4.07	3.73	4.6	4.81	8.82 4.96
Mass	Stator	m _S	kg	84			108	133
	Rotor	m _R	kg	65			80	97
Number of pole pairs		p		3				
Thermal time constant		t _{th}	min	i.p.				
Permissible ambient temperature		t _U	°C	0...40				
Permissible storage and transport temperature		t _L	°C	-20...+80				
Insulation class according to DIN VDE 0530-1				F				
Class of motor protection				IP00				

Liquid cooling								
Rated power loss		P _{VN}	kW	3.5			3.8	5.5
Liquid cooling temperature at inlet		ϑ _{in}	°C	10...40				
Temperature rise at P _{VN} ⁴⁾		Δϑ _N	K	10				
Required liquid cooling flow at Δϑ _N ⁴⁾		Q _N	l/min	5			5.4	7.9
Decompression at Q _N		Δp	bar	0.2				0.3
Permissible inlet pressure		p _{max}	bar	3				
Volume liquid cooling duct		V	l	1.4			1.8	2.2

¹⁾ The determined values are root-mean-square according to IEC 60034-1, if no others are given. Reference value 540 V_{DC} intermediate circuit voltage.

²⁾ Measured according to EN60204-1 (1993), installation mode B2 and conversion factor for Rexroth cables at 40°C ambient temperature. When using other cables, larger cross-sections may be required.

³⁾ Inductivity of the mounted motor spindle at 20°C. Measurement between two phases with f_L = 1kHz.

⁴⁾ The data refer to operation with liquid cooling (cooling medium is water).

Fig. 4-14: 1MB310 data sheet

4.12 Technical Data for 1MB375

Description		Symbol	Unit	1MB375	
Motor data ¹⁾					
Frame length			B	D	
Winding code			6B	6B	6D
Rated torque	M _N	Nm	636	875	
Rated speed	n _N	rpm	600	600	300
Rated power	P _N	kW	40	55	27.5
Rated current	I _N	A	120	150	94
Nominal voltage	U _{neff}	V	280	304	260
Max. voltage	I _{max}	A	257.2	329.3	210
Maximum speed	n _{max}	rpm	2400	2400	1200
Min. cross-section of power connector ²⁾	A	mm ²	50	2x25	35
Moment of inertia of the rotor	J _m	kgm ²	1.39	1.73	1.73
Winding resistance	R	Ω	0.097	0.082	0.2052
Inductivity ³⁾	L	mH	2	1.26	3.1
Constant torque at 20°C	K _m	Nm/A	6.28	6.75	10.58
Mass	Stator	m _S	kg	205	
	Rotor	m _R	kg	132	
Number of pole pairs	p		3		
Thermal time constant	t _{th}	min	i.p.		
Permissible ambient temperature	t _U	°C	0...40		
Permissible storage and transport temperature	t _L	°C	-20...+80		
Insulation class acc. to DIN VDE 0530-1			F		
Class of motor protection			IP00		

Liquid cooling					
Rated power loss	P _{VN}	kW	5.1	6.5	
Liquid cooling temperature at inlet	ϑ _{in}	°C	10...40		
Temperature rise at P _{VN} ⁴⁾	Δϑ _N	K	10		
Required liquid cooling flow at Δϑ _N ⁴⁾	Q _N	l/min	7.3	9.3	
Decompression at Q _N	Δp	bar	0.3	0.5	
Permissible inlet pressure	p _{max}	bar	3		
Volume liquid cooling duct	V	l	2.7	3.5	

¹⁾ The determined values are root-mean-square according to IEC 60034-1, if no others are given. Reference value 540 V_{DC} intermediate circuit voltage.

²⁾ Measured according to EN60204-1 (1993), installation mode B2 and conversion factor for Rexroth cables at 40°C ambient temperature. When using other cables, larger cross-sections may be required.

³⁾ Inductivity of the mounted motor spindle at 20°C. Measurement between two phases with f₋ = 1kHz.

⁴⁾ The data refer to operation with liquid cooling (cooling medium is water).

Fig. 4-15: 1MB375 data sheet

5 Dimensions sheet 1MB

For your orientation:

The dimension drawings in this chapter are combined according to the sizes. The drawings for each size always follow in this order:

- Standard dimension sheet of the complete motor.
- Component drawing of the rotor.
- Component drawing of the stator.

The dimensions and tolerances shown in the drawings are according to the following standards:

Length dimensions: DIN ISO 2768, part 1
Angular dimensions: DIN 7168 middle
Form and position tolerances: DIN ISO 1101

5.1 Dimensions sheet 1MB140

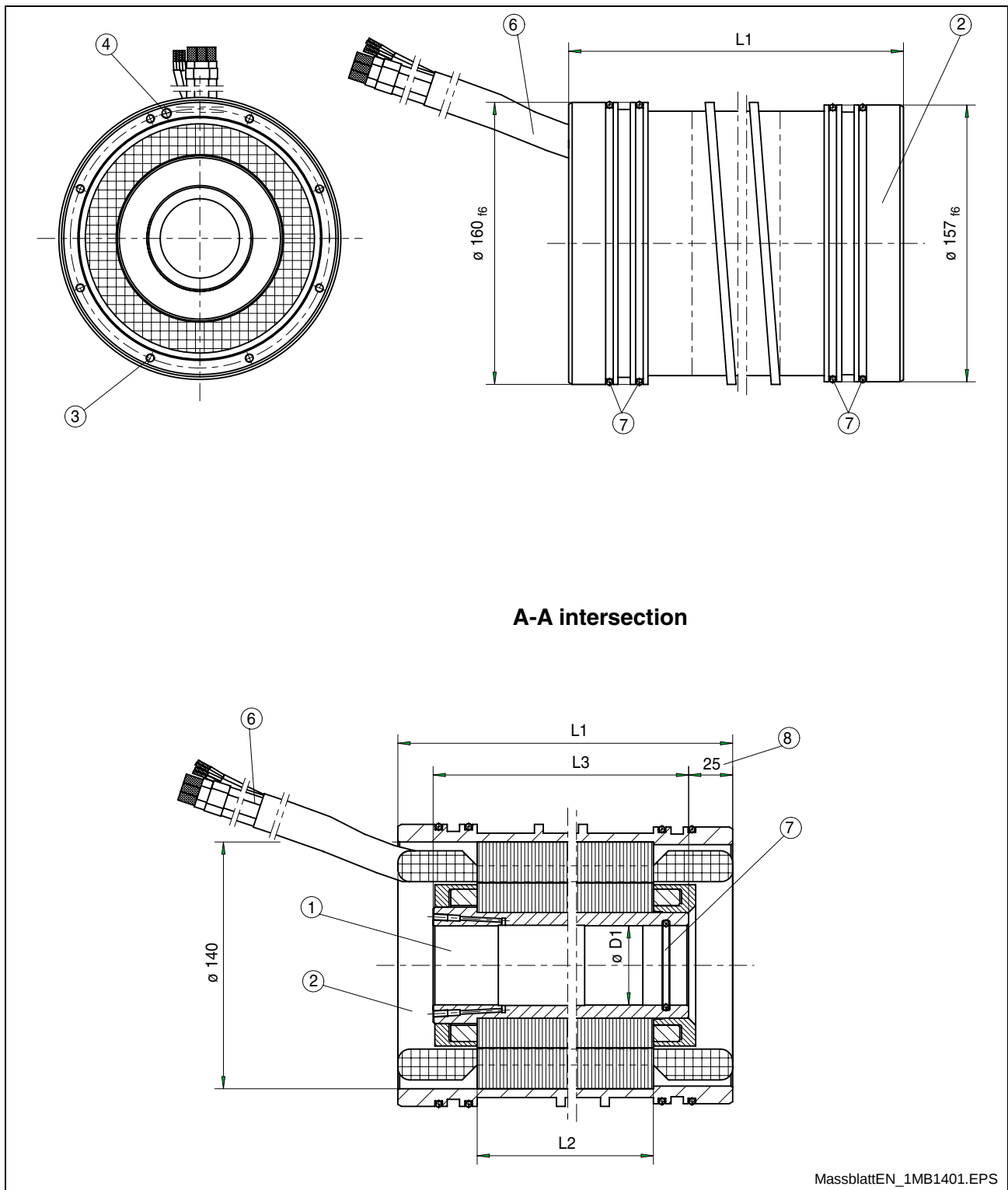
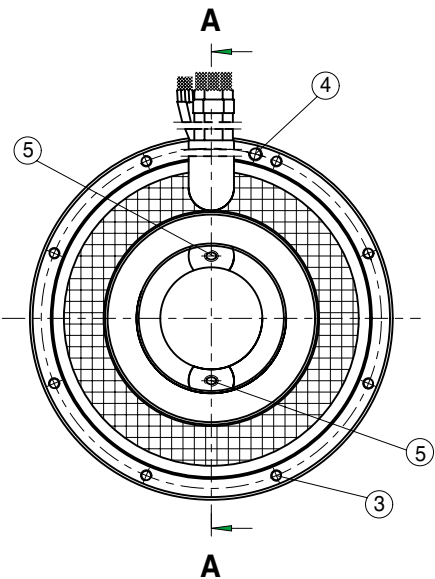


Fig. 5-1: Dimensions sheet 1MB140 (1/2)



- ① Rotor 1MR 140...
- ② Stator 1MS 140...
- ③ 8x M5 thread for axial mounting to spindle housing
- ④ M6 thread for mounting to ground terminal line
- ⑤ pressure oil connection to release step interference fit
- ⑥ motor winding with 1500 mm length
- ⑦ O-ring made of Viton
- ⑧ Positional dimension of rotor to stator

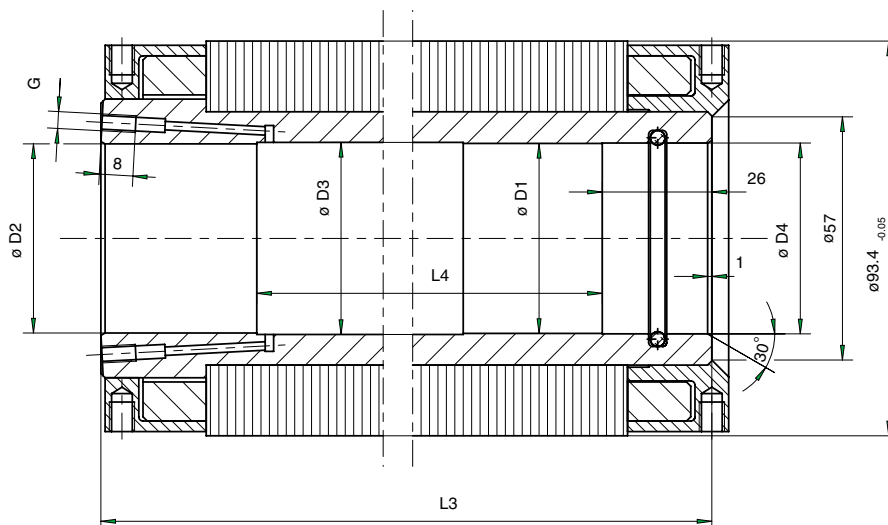
Dim. Type	$\varnothing D 1^{H6}$	L 1	L 2	L 3
1 MB 140 B	4 5	1 5 0	6 0	1 0 5
1 MB 140 D		1 9 0	1 0 0	1 4 5
1 MB 140 F		2 4 0	1 5 0	1 9 5
1 MB 140 H		2 9 0	2 0 0	2 4 5

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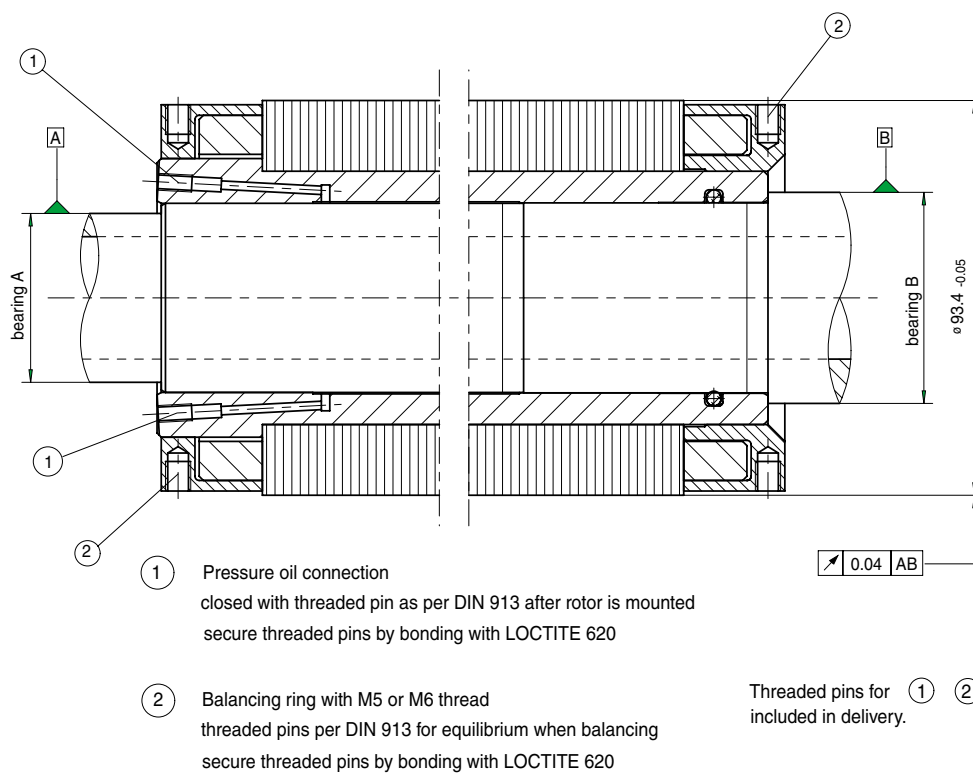
Fig. 5-2: Dimensions sheet 1MB140 (2/2)

Rotor - 1MR140

Rotor 1 MR 140...



Rotor mounted to spindle



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Fig. 5-3: Dimensions sheet 1MR140 (1/2)

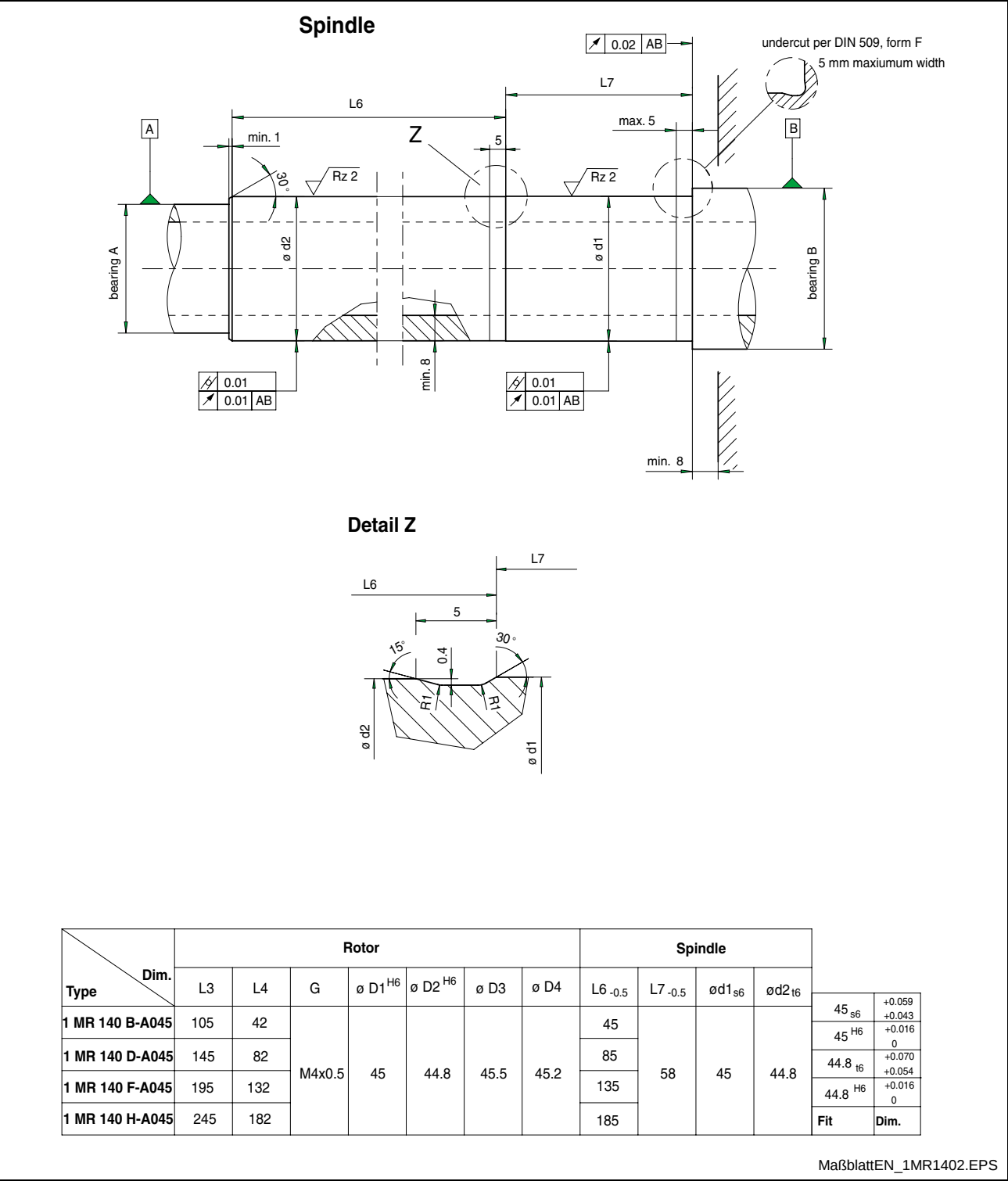
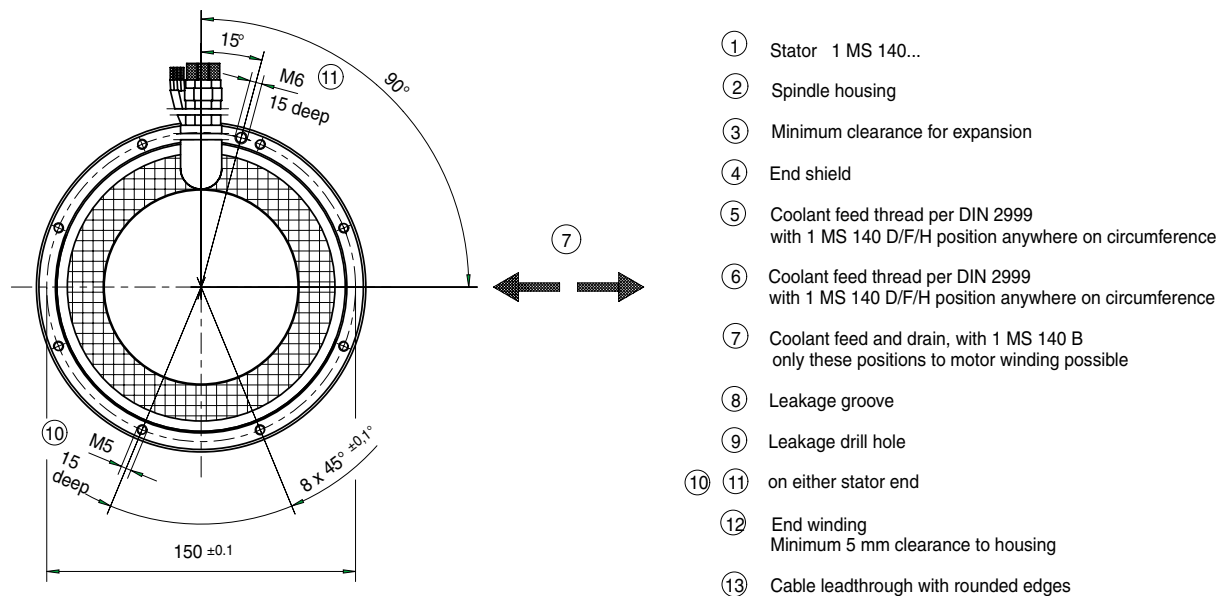


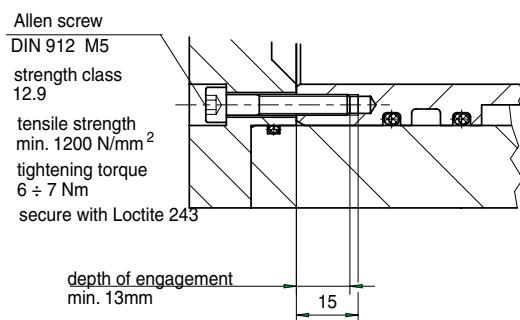
Fig. 5-4: Dimensions sheet 1MR140 (2/2)

Fig. 5-5: Dimensions sheet Stator 1MS140 (1/2)

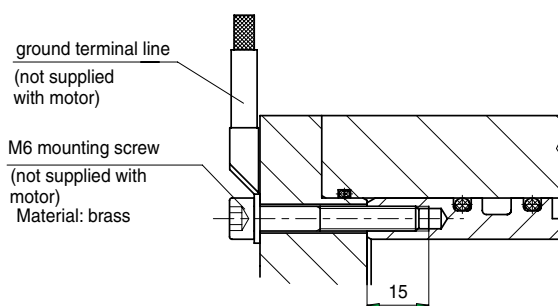


Type	Dim.	L1	L8 ⁺¹	L9 ₋₂	L10 ₋₁ ⁺¹	motor winding	
						øD	bend radius
1 MS 140 B-4B	150	101	91	118.5			
1 MS 140 D-4B	190	141	131	158.5		20	70
1 MS 140 F-4A	240	191	181	208.5			
1 MS 140 H-4B	290	241	231	258.5		22	90

⑩ Axial mounting to end shield



⑪ Ground terminal line connection



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Fig. 5-6: Dimensions sheet Stator 1MS140 (2/2)

5.2 Dimensions sheet 1MB160

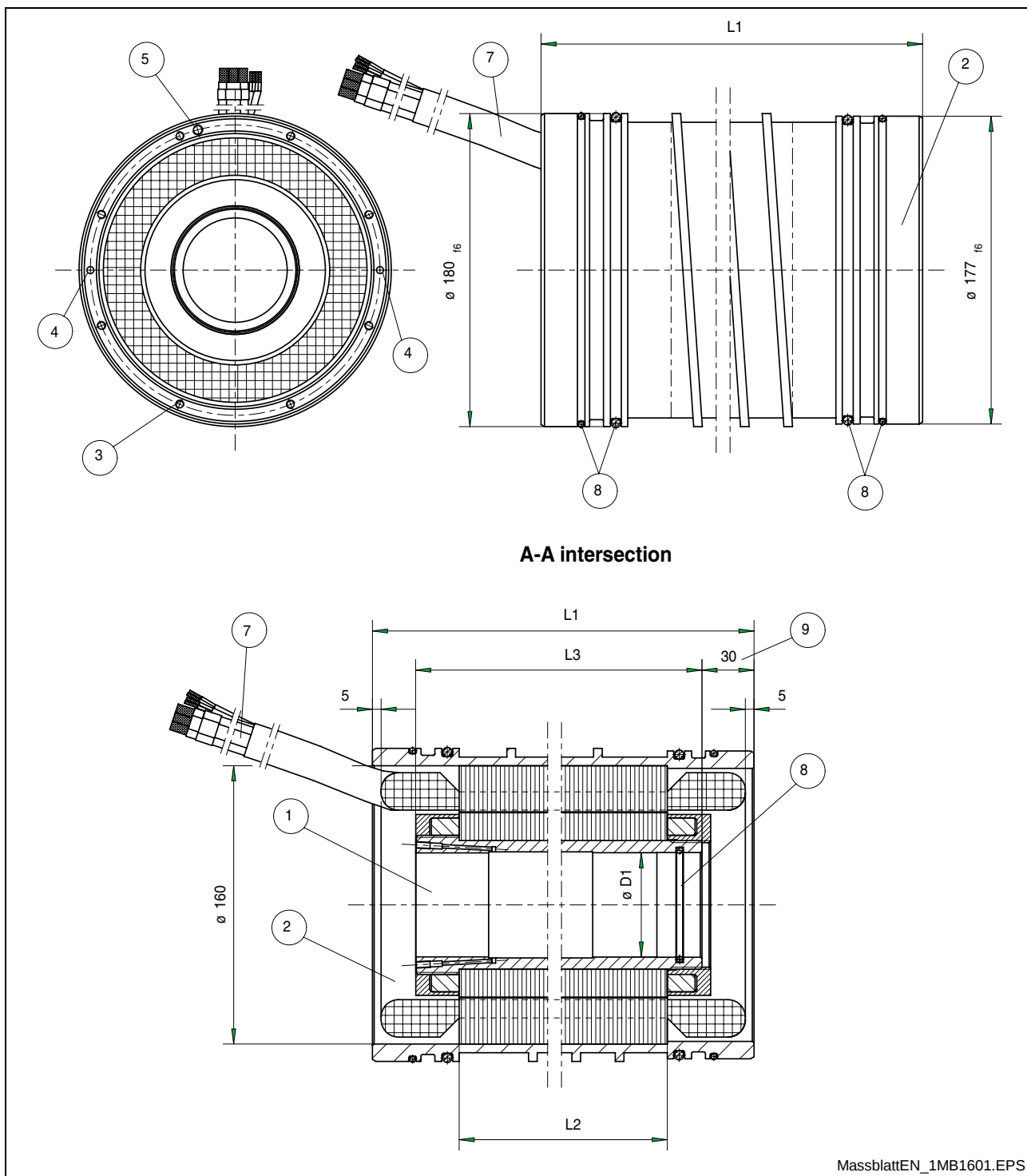
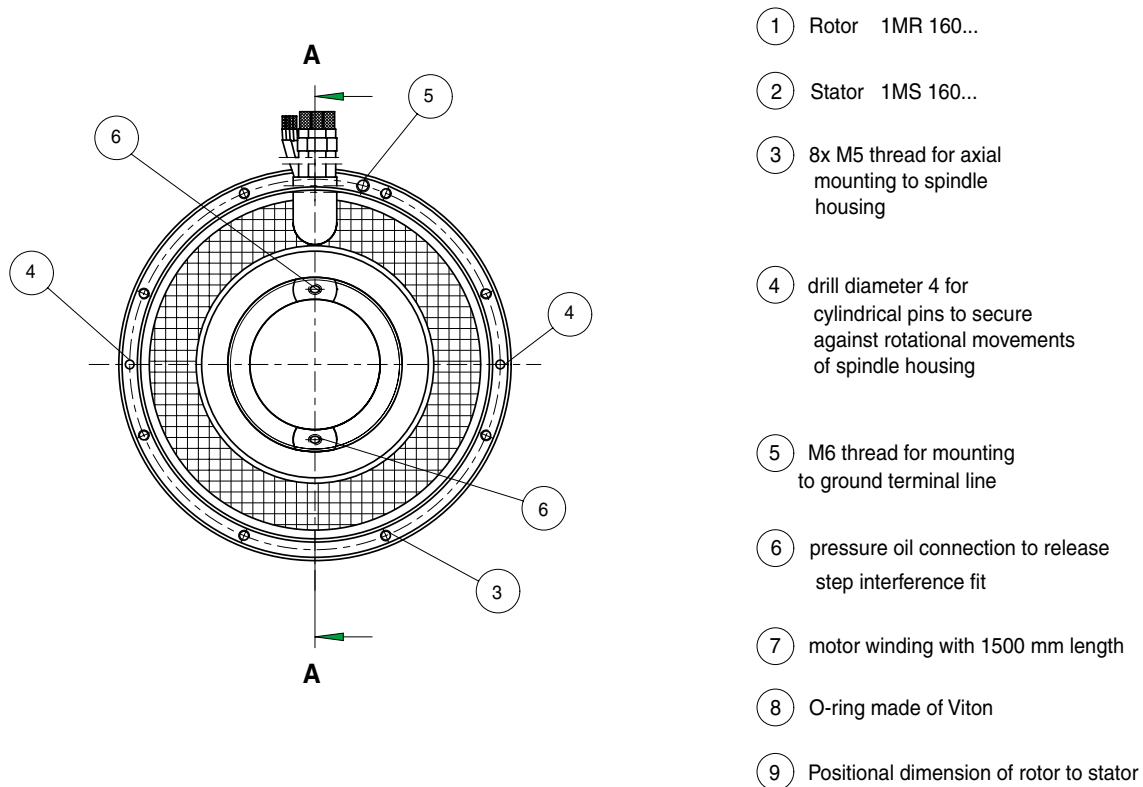


Fig. 5-7: Dimensions sheet 1MB160 (1/2)



Dim. Type	$\varnothing D 1 \quad H6$				L 1	L 2	L 3
1 MB 160 B		55	60		160	60	105
1 MB 160 D	40	55	60	60,3	205	105	150
1 MB 160 E			60		240	140	185
1 MB 160 F	40	55	60	60,3	255	155	200
1 MB 160 H			60	60,3	310	210	255
1 MB 160 N			60	60,3	385	285	330

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Fig. 5-8: Dimensions sheet 1MB160 (2/2)

Rotor 1MR 160... (conditions at delivery)

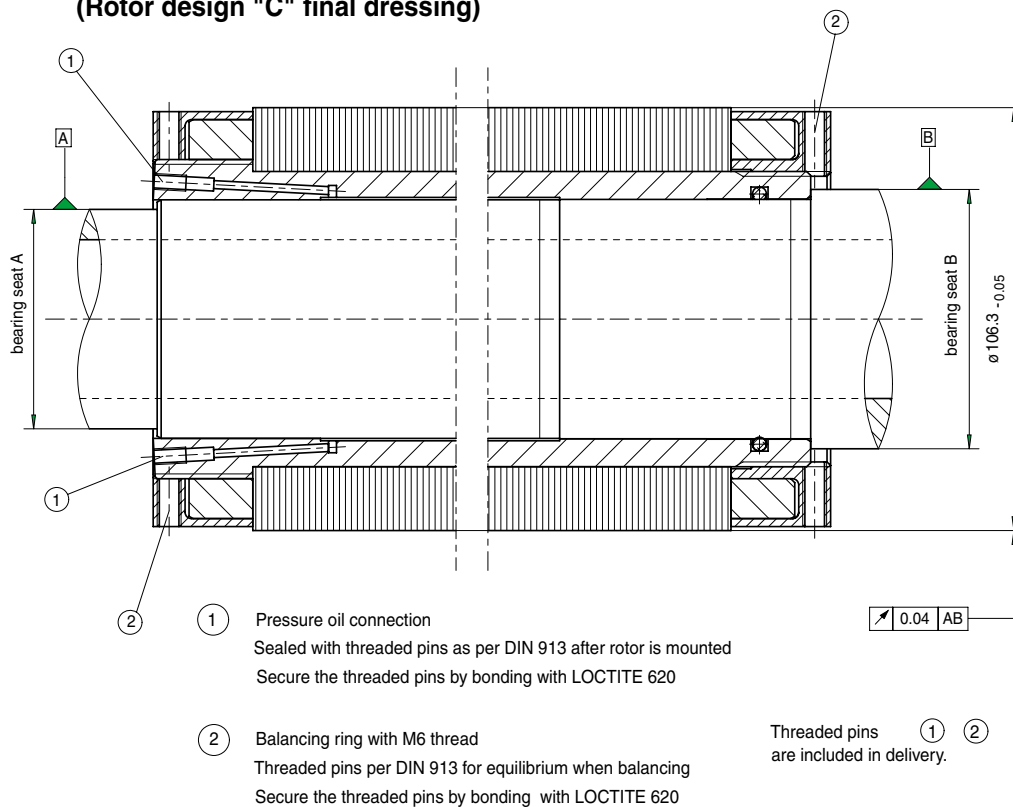
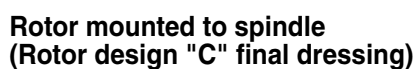
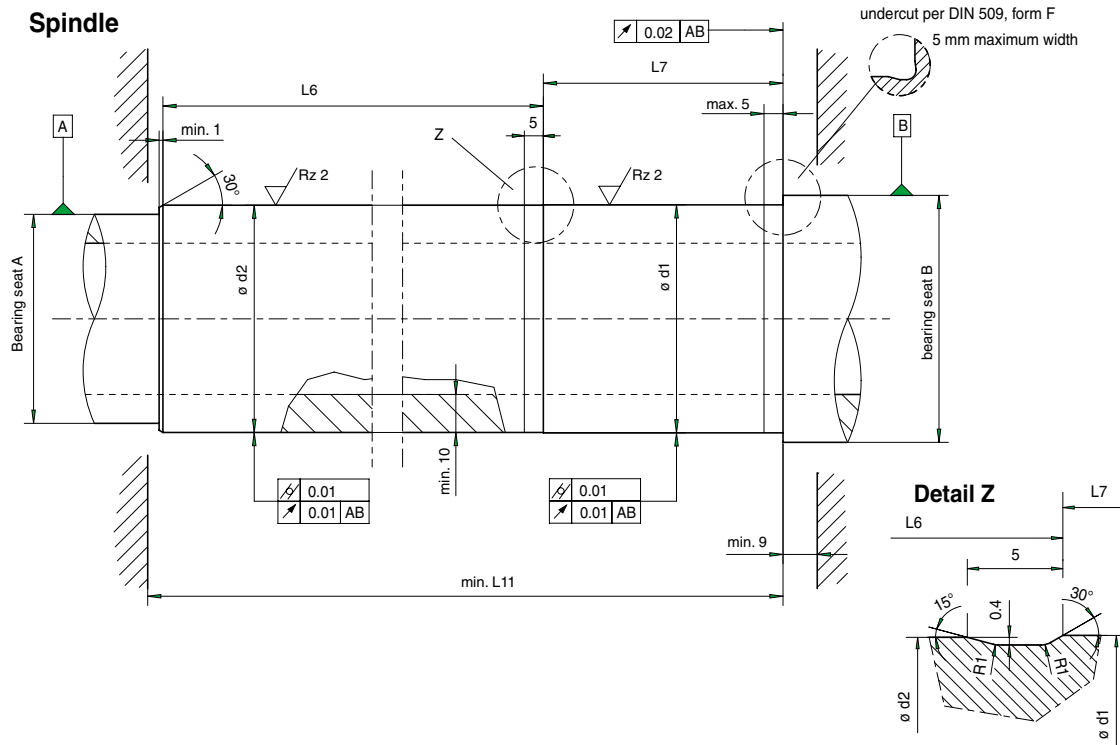


Fig. 5-9: Dimensions sheet Rotor 1MR160 (1/2)



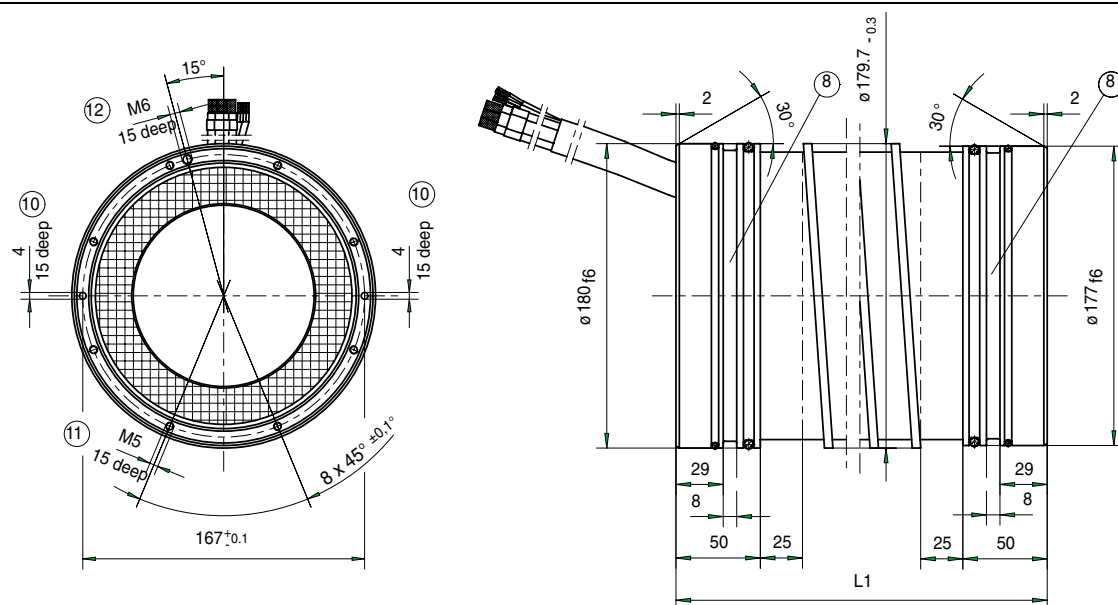
Type	Dim.	Rotor						Spindle					60.3 _{s6}	+0.072 +0.053					
		L3	L4	G	ø D1 ^{H6}	ø D2 ^{H6}	ø D3	ø D4	L6 ^{-0.5}	L7 ^{-0.5}	ød1 _{s6}	ød2 _{t6}			L11				
1 MR 160 B-x040	105	42	M6	40	39.8	41	40.2	45	58	40	39.8	min. 107	60.1 _{t6}	+0.085 +0.066					
1 MR 160 D-x040	150	82						85	63			min. 152	60.1 _{H6}	+0.019 0					
1 MR 160 E-x040	185	117						120				min. 187	60 _{s6}	+0.072 +0.053					
1 MR 160 F-x040	200	132						135				min. 202	60 _{H6}	+0.019 0					
																	59.8 _{t6}	+0.085 +0.066	
																	59.8 _{H6}	+0.019 0	
1 MR 160 B-x055	105	42	M4x0.5	55	54.8	56	55.2	45	58	55	54.8	min. 107	55 _{s6}	+0.072 +0.053					
1 MR 160 D-x055	150	82						85	63			min. 152	55 _{H6}	+0.019 0					
1 MR 160 E-x055	185	117						120				min. 187	54.8 _{t6}	+0.085 +0.066					
1 MR 160 F-x055	200	132						135				min. 202	54.8 _{H6}	+0.019 0					
1 MR 160 B-x060	105	42						60	59.8			61	60.2	45	58	60	59.8	min. 107	
1 MR 160 D-x060	150	82		85	63	min. 152	45 _{s6}			+0.059 +0.043									
1 MR 160 E-x060	185	117		120		min. 187	45 _{H6}			+0.016 0									
1 MR 160 F-x060	200	132		135		min. 202	44.8 _{t6}			+0.070 +0.054									
1 MR 160 H-x060	255	187		190	265	min. 257	44.8 _{H6}			+0.016 0									
1 MR 160 N-x060	330	262		265		min. 332													
1 MR 160 B-x061	105	42		60.3	60.1	61	60.5	45	58	60.3	60.1	min. 107	40 _{s6}	+0.059 +0.043					
1 MR 160 D-x061	150	82						85	63			min. 152	40 _{H6}	+0.016 0					
1 MR 160 E-x061	185	117						120				min. 187	39.8 _{t6}	+0.064 +0.048					
1 MR 160 F-x061	200	132						135				min. 202	39.8 _{H6}	+0.016 0					
1 MR 160 H-x061	255	187						190	265			min. 257							
1 MR 160 N-x061	330	262						265				min. 332	Fit	Dim.					

X = Rotor design "A" or "C"

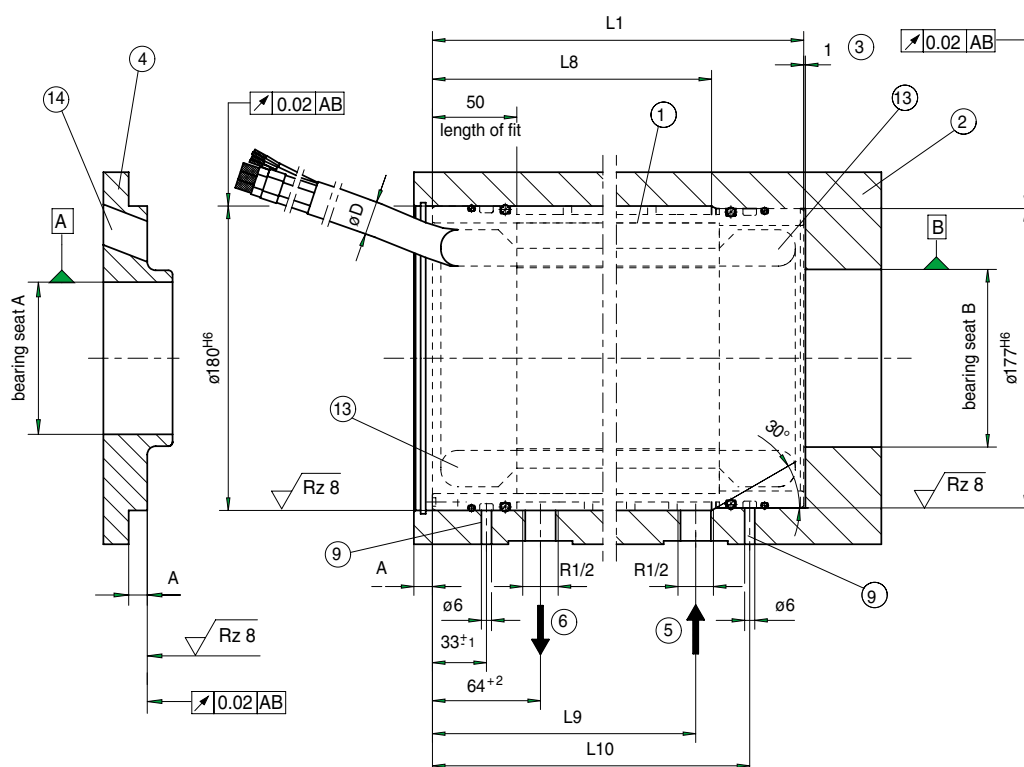
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Fig. 5-10: Dimensions sheet Rotor 1MR160 (2/2)

Stator 1MS160

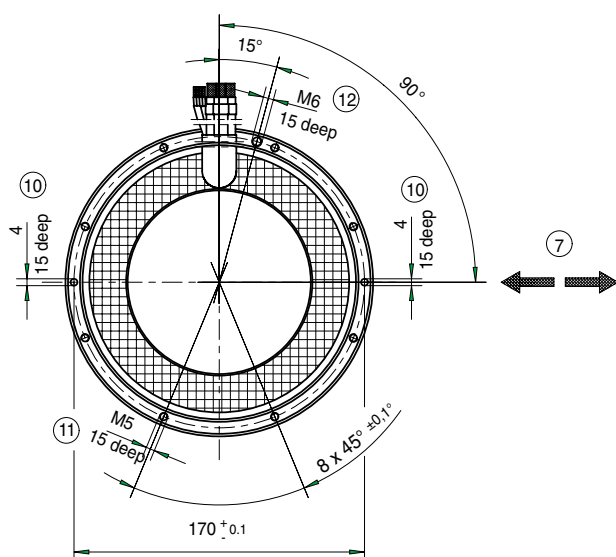


Mounting drill hole :
for axial mounting of the stator to end shield



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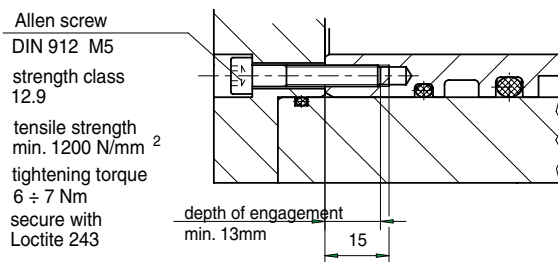
Fig. 5-11: Dimensions sheet 1MS160 (1/2)



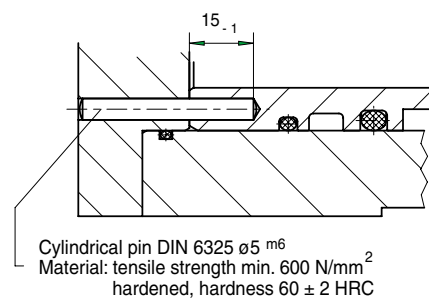
- ① Stator 1 MS 160...
- ② Spindle housing
- ③ Minimum clearance for expansion
- ④ End shield
- ⑤ Coolant feed thread as per DIN 2999 with 1 MS 160 D/E/F/H/N position anywhere on circumference
- ⑥ Coolant drain thread as per DIN 2999 with 1 MS 160 D/E/F/H/N position anywhere
- ⑦ Coolant flow and drain, for 1 MS 160 B only possible in these positions to motor cable
- ⑧ Leakage groove
- ⑨ Leakage drill hole
- ⑩ ⑪ ⑫ on either stator end
- ⑬ End winding clearance to housing is at least 5 mm
- ⑭ Cable leadthrough with rounded edges

Type	Dim.	L1	L8 ⁺¹	L9 ⁻²	L10 ^{±1}	motor winding	
						øD	bend radius
1 MS 160 B-4A	160	106	96	127	20	70	
1 MS 160 D-4A	205	151	141	172			
1 MS 160 E-4B	240	186	176	207			
1 MS 160 F-4A	255	201	191	222	22	90	
1 MS 160 F-4B					20	70	
1 MS 160 H-4A	310	256	246	277	22	90	
1 MS 160 N-4A	385	331	321	352			

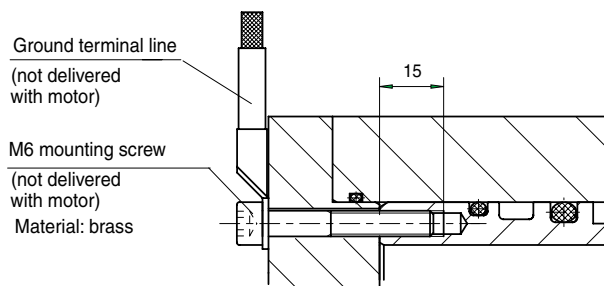
⑪ Axial mounting to end shield



⑩ Securing against rotations on end shield



⑫ Attachment of ground terminal connection



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Fig. 5-12: Dimensions sheet 1MS160 (2/2)

5.3 Dimensions sheet 1MB200

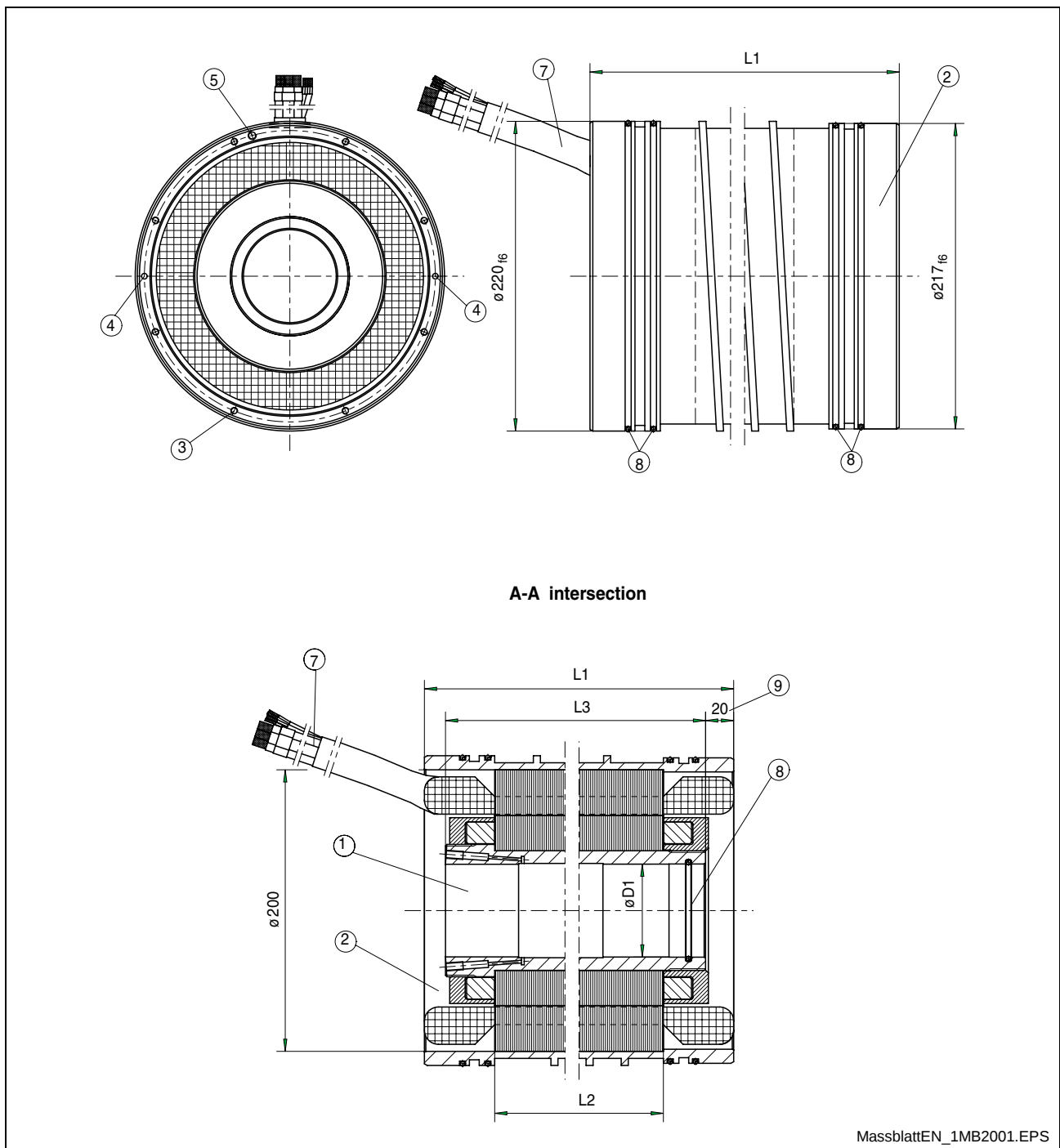
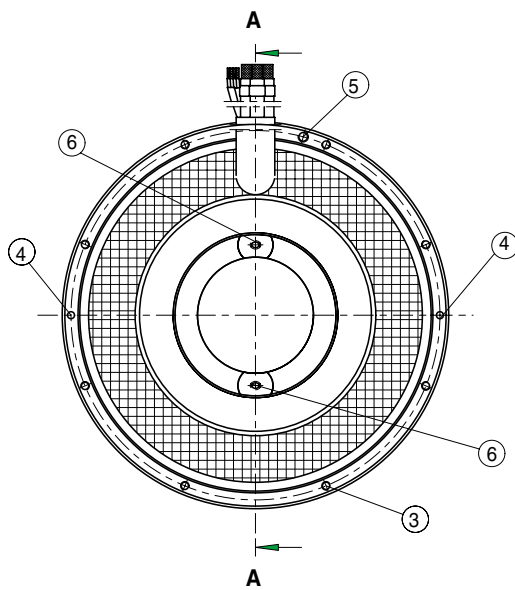


Fig. 5-13: Dimensions sheet 1MB200 (1/2)



- ① Rotor 1MR 200...
- ② Stator 1MS 200...
- ③ 8x M5 thread for axial mounting to spindle housing
- ④ $\varnothing 4$ drill hole for cylindrical pins to secure against rotations with respect to spindle housing
- ⑤ M6 thread for mounting to ground terminal connection
- ⑥ pressure oil connection to release step interference fit
- ⑦ 1500 mm long motor winding
- ⑧ O-ring made of viton
- ⑨ Positional dimension of rotor to stator

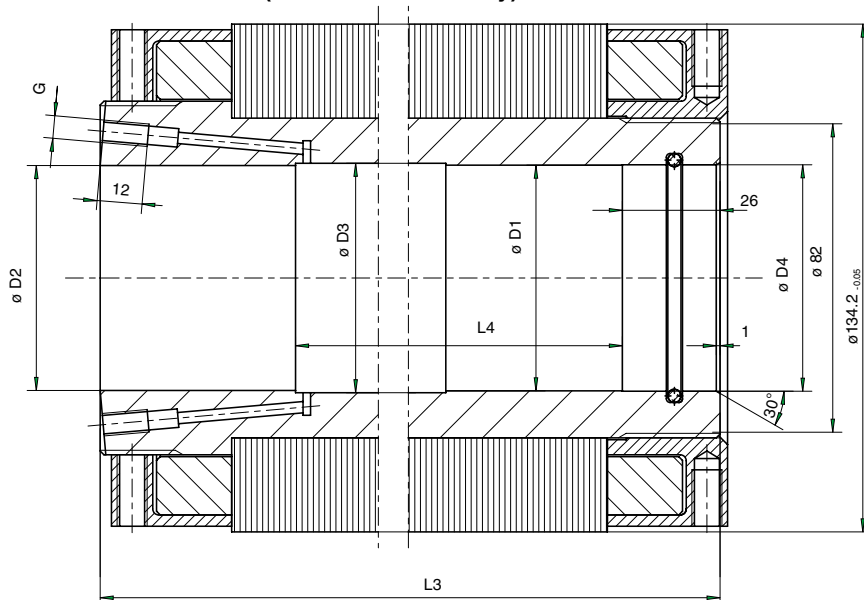
Dim. Type	$\varnothing D 1^{H6}$		L 1	L 2	L 3
1 MB 200 C	60	66	240	140	205
1 MB 200 D			295	195	260
1 MB 200 E			330	230	295
1 MB 200 H			380	280	345

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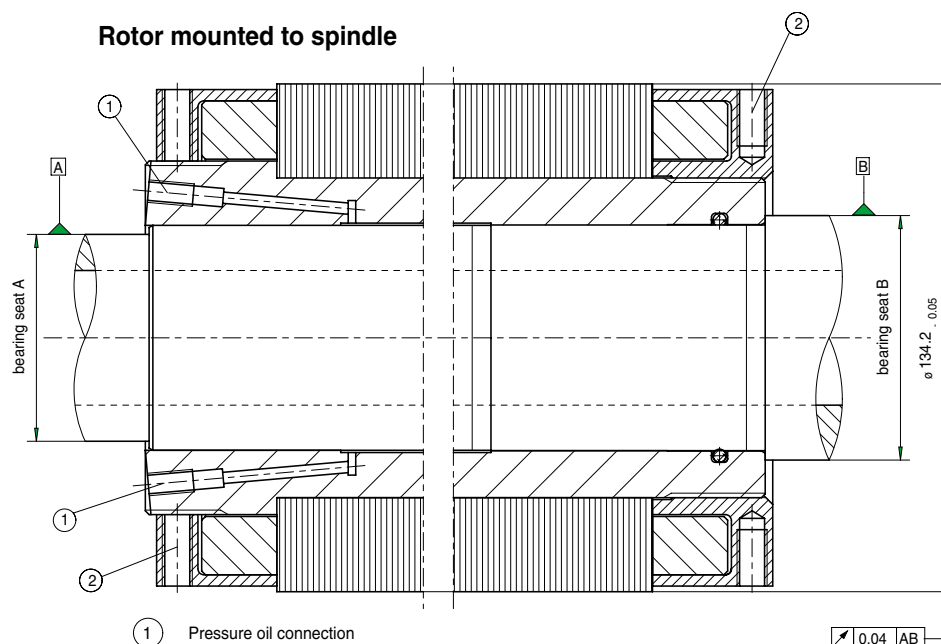
Fig. 5-14: Dimensions sheet 1MB200 (2/2)

Rotor - 1MR200

Rotor 1MR 200... (condition at delivery)



Rotor mounted to spindle



- ① Pressure oil connection
Sealed with threaded pins per DIN 913 after rotor is mounted
Secure the threaded pins by bonding with LOCTITE 620

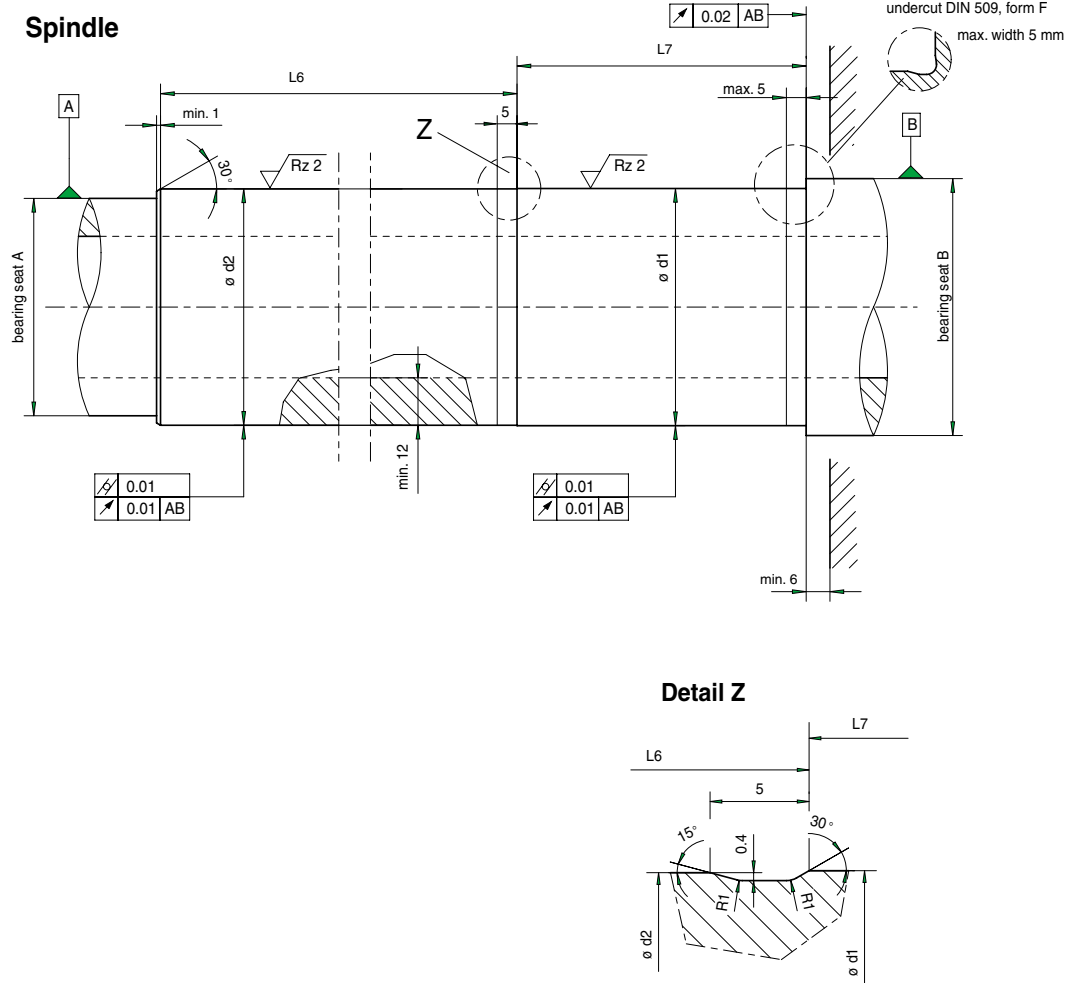
- ② Balancing ring with M6 or M8 thread
Threaded pins per DIN 913 for equilibrium when balancing
Secure the threaded pins by bonding with LOCTITE 620

Threaded pins ① ②
are part of general delivery.

0.04 AB

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Fig. 5-15: Dimensions sheet Rotor 1MR200 (1/2)

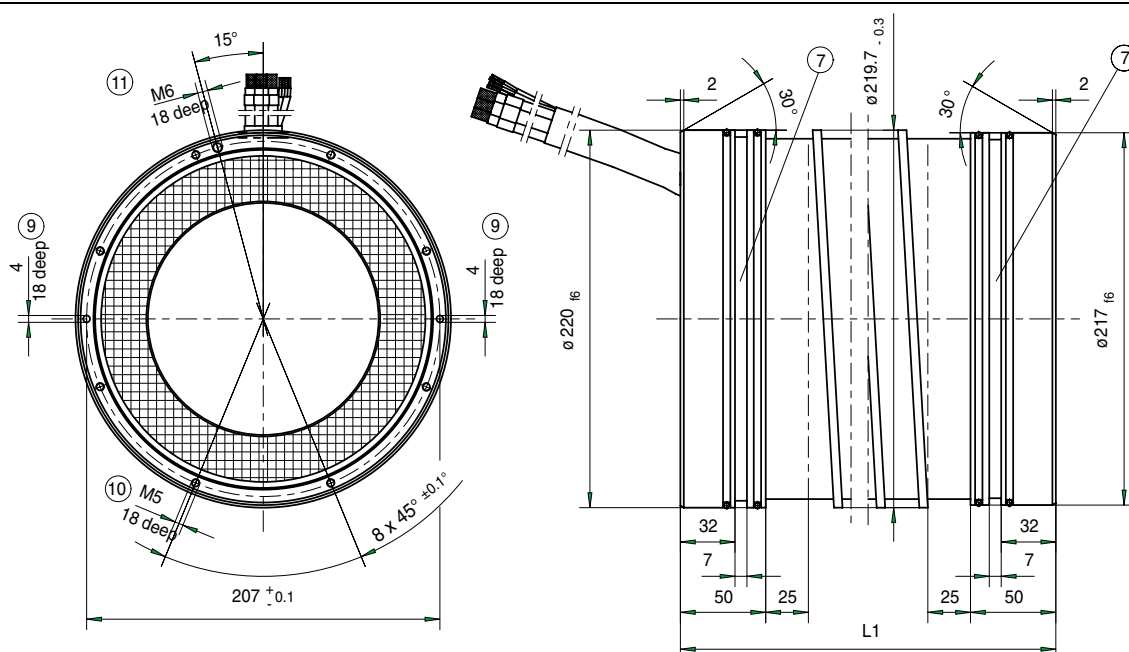


Type	Dim.	Rotor						Spindle					
		L3	L4	G	ø D1 ^{H6}	ø D2 ^{H6}	ø D3	ø D4	L6 ^{-0.5}	L7 ^{-0.5}	ød1 _{s6}	ød2 _{t6}	
1 MR 200 C-A060	205	127	M6	60	59.8	61	60.2	130	73	60	59.8	66 _{s6}	+0.078 +0.059
1 MR 200 D-A060	260	182						185				66 ^{H6}	+0.019 0
1 MR 200 E-A060	295	217						220				65.8 _{t6}	+0.094 +0.075
1 MR 200 H-A060	345	267						270				65.8 ^{H6}	+0.019 0
1 MR 200 C-A066	205	127		66	65.8	67	66.2	130		66	65.8	60 _{s6}	+0.072 +0.053
1 MR 200 D-A066	260	182						185				60 ^{H6}	+0.019 0
1 MR 200 E-A066	295	217						220				59.8 _{t6}	+0.085 +0.066
1 MR 200 H-A066	345	267						270				59.8 ^{H6}	+0.019 0
												Fit	Dim.

MaßblattEN_1MR2002.EPS

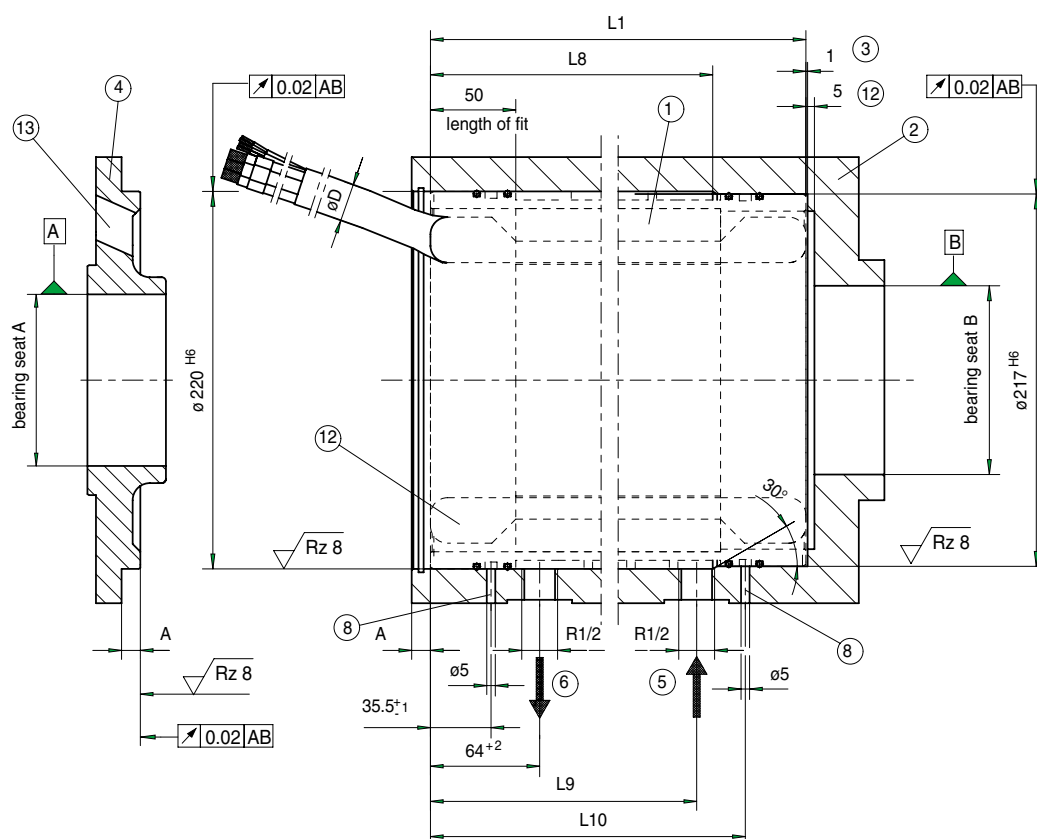
Fig. 5-16: Dimensions sheet Rotor 1MR200 (2/2)

Stator 1MS200



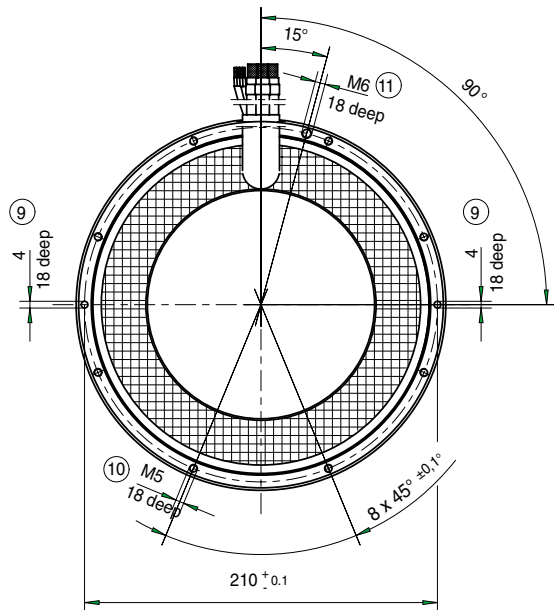
Mounting drill hole:

for axial mounting of the stator to the end shield



MaßblattEN_1MS2001.EPS

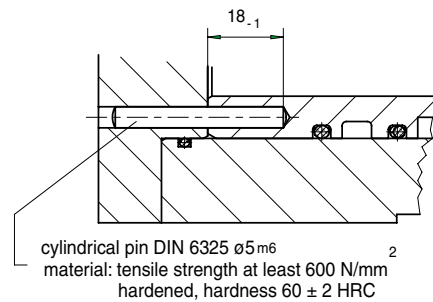
Fig. 5-17: Dimensions sheet 1MS200 (1/2)



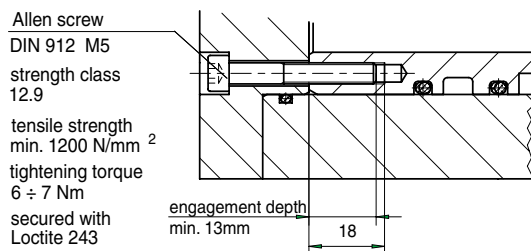
- ① Stator 1 MS 200...
- ② Spindle housing
- ③ Minimum clearance for expansion
- ④ end shield
- ⑤ coolant feed per DIN 2999 positioned anywhere on circumference
- ⑥ coolant thread as per DIN 2999 anywhere on circumference
- ⑦ Leakage groove
- ⑧ Leakage drill hole
- ⑨ ⑩ ⑪ on either stator end
- ⑫ end winding clearance to housing at least 5 mm
- ⑬ cable leadthrough with rounded edges

Type	Dim.	L1	L8 +1	L9 -2	L10 ± 1	motor winding	
						øD	bend radius
1 MS 200 C-4A		240	186	176	204.5	20	70
1 MS 200 D-4B							
1 MS 200 D-4C							
1 MS 200 D-4D							
1 MS 200 D-4E							
1 MS 200 E-4B		330	276	266	294.5	22	90
1 MS 200 H-4B		380	326	316	344.5		

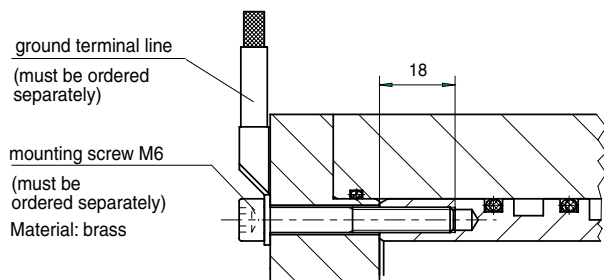
⑨ Secure against movements on end shield



⑩ Axial mounting on end shield



⑪ Attachment of ground terminal connection



MaßblattEN_1MS2002.EPS

Fig. 5-18: Dimensions sheet 1MS200 (2/2)

5.4 Dimensions sheet 1MB240

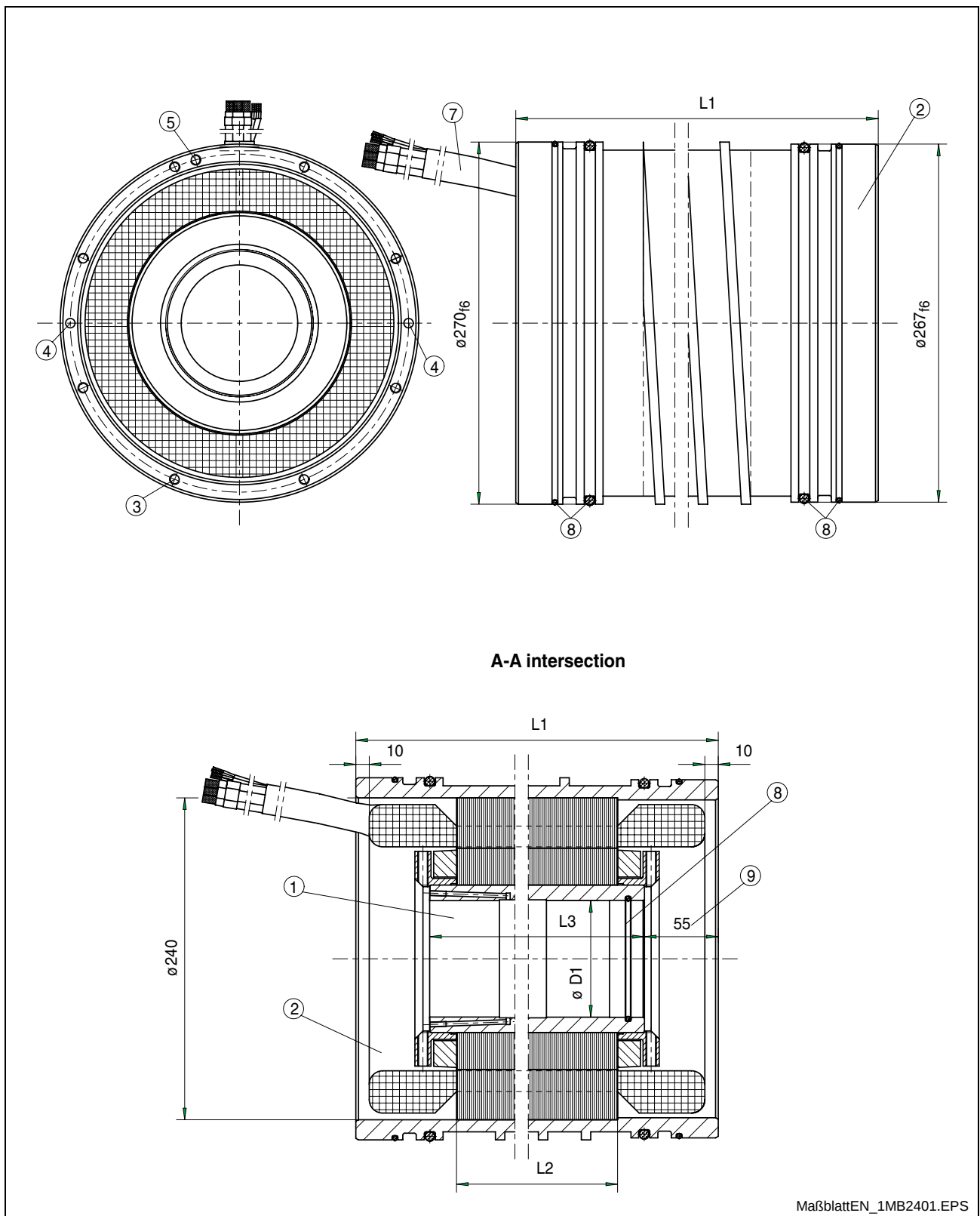
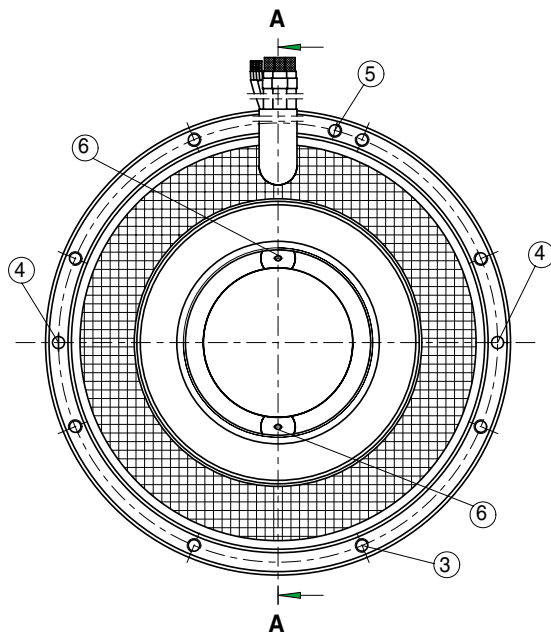


Fig. 5-19: Dimensions sheet 1MB240 (1/2)



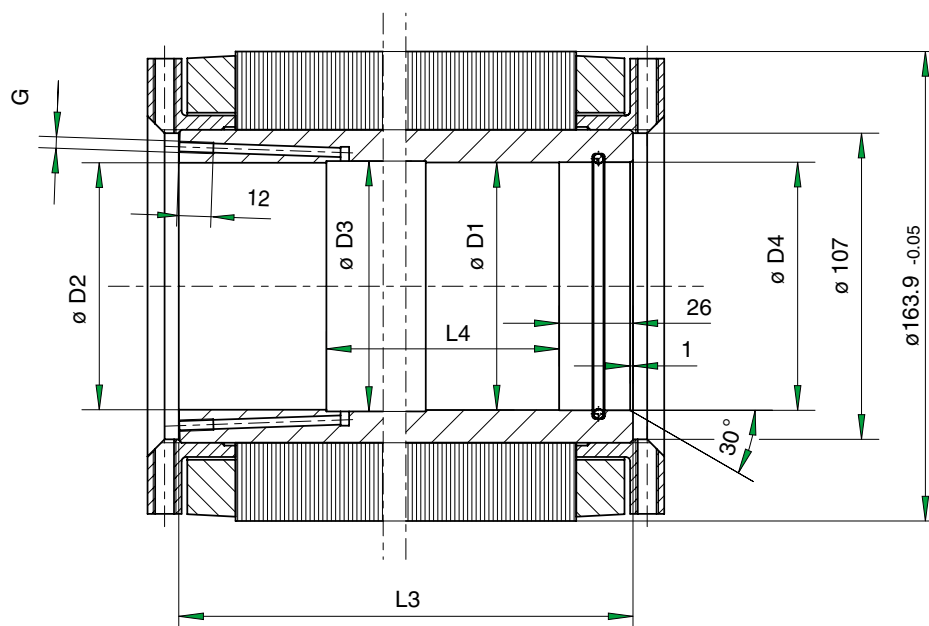
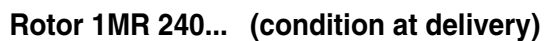
- ① Rotor 1MR 240...
- ② Stator 1MS 240...
- ③ 8x M8 thread for axial mounting to spindle housing
- ④ ø7 drill hole for cylindrical pins to secure against rotational motions with respect to spindle housing
- ⑤ M8 thread for mounting of ground terminal line
- ⑥ pressure oil connection to release step interference fit
- ⑦ motor winding length 1500 mm
- ⑧ O-ring made of Viton
- ⑨ Positional dimension of rotor to stator

Dim. Type	$\varnothing D 1^{H6}$		L 1	L 2	L 3
1 MB 240 B	72	87	270	120	160
1 MB 240 D			310	160	200
1 MB 240 F			360	210	250
1 MB 240 H			430	280	320

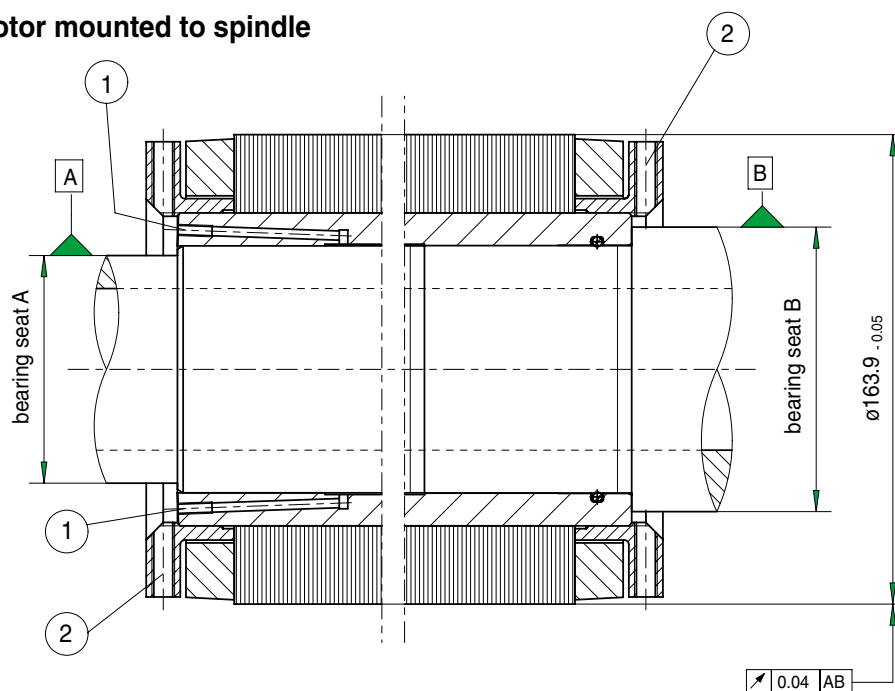
MaßblattEN_1MB2402.EPS

Fig. 5-20: Dimensions sheet 1MB240 (2/2)

Rotor - 1MR240



Rotor mounted to spindle

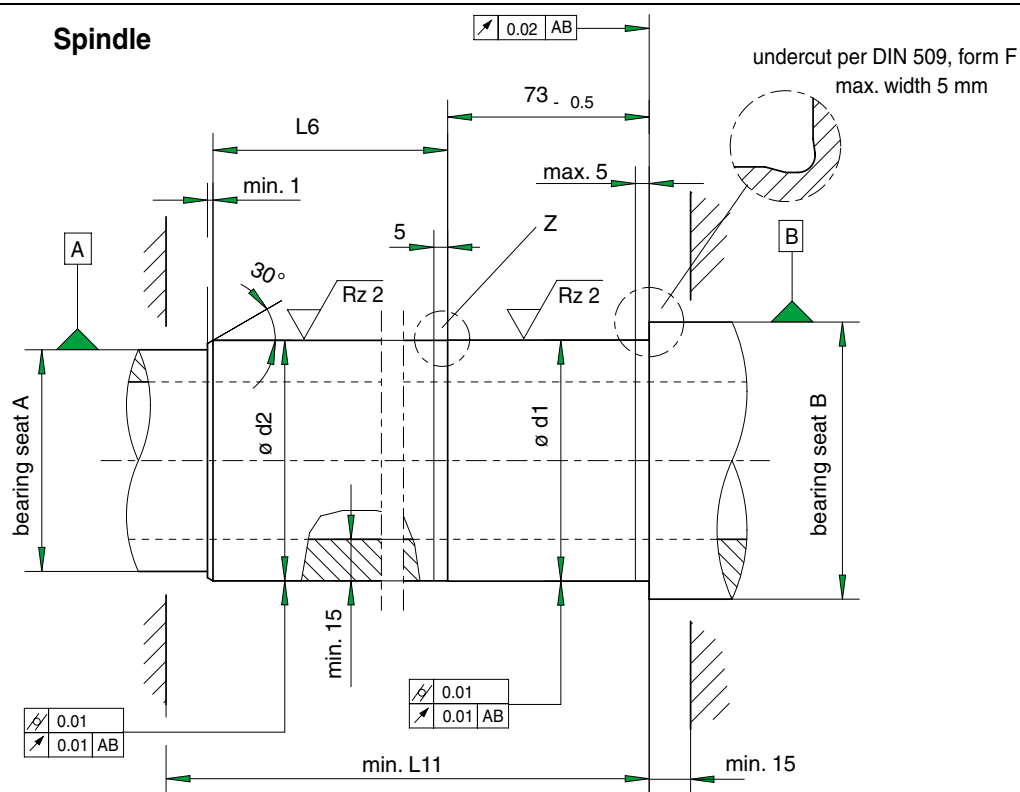
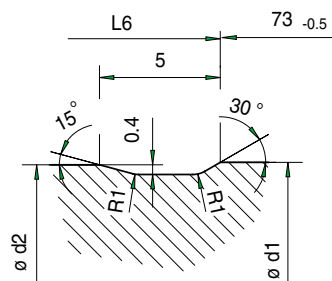


- 1 Pressure oil connection
Sealed with threaded pins DIN 913 after rotor is mounted
Secure the threaded pins by bonding with LOCTITE 620
- 2 Balancing ring with M8 thread
Threaded pins per DIN 913 for equilibrium when balancing
Secure the threaded pins by bonding with LOCTITE 620

Threaded pins for ① ②
are supplied with general delivery.

MaßblattEN_1MR2401.EPS

Fig. 5-21: Dimensions sheet Rotor 1MR240 (1/2)

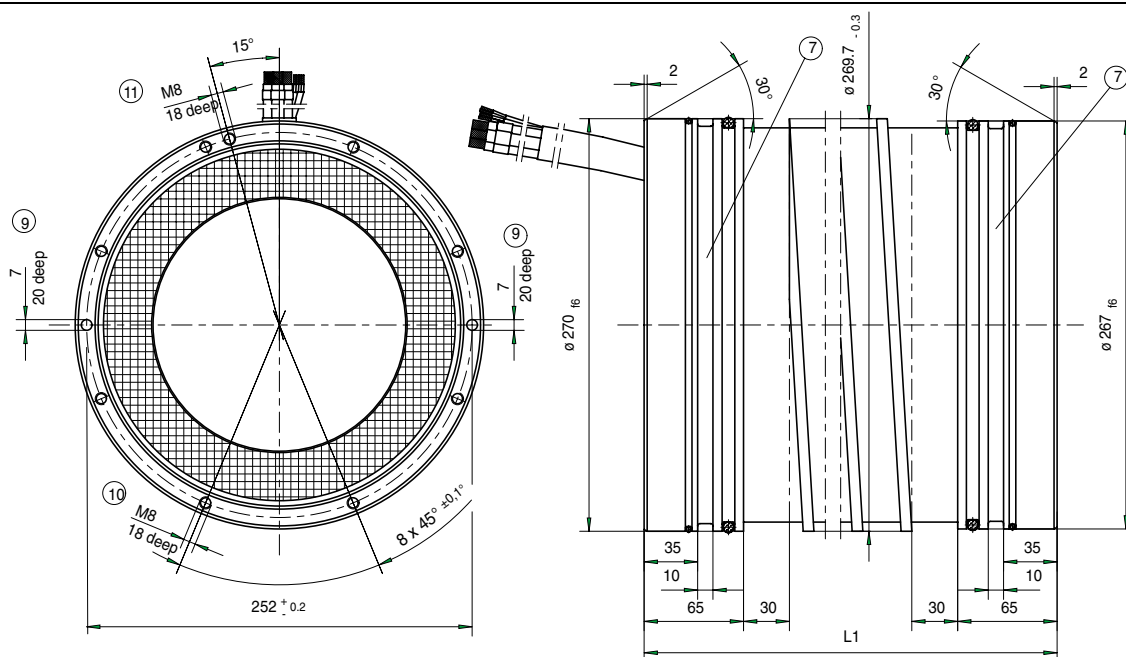
**Detail Z**

Type	Dim.	Rotor						Spindle					
		L3	L4	G	ø D1 ^{H6}	ø D2 ^{H6}	ø D3	ø D4	L6 ^{-0.5}	ød1 ^{s6}	ød2 ^{t6}	L11	87 ^{s6}
1 MR 240 B-A072	160	82	M6	72	71.8	73	72.2	85	72	71.8	175	87 ^{H6}	+0.022 0
1 MR 240 D-A072	200	122						125			215	86.8 ^{t6}	+0.113 +0.091
1 MR 240 F-A072	250	172						175			265	86.8 ^{H6}	+0.022 0
1 MR 240 H-A072	320	242						245			335	72 ^{s6}	+0.078 +0.059
1 MR 240 B-A087	160	82	M4x0.5	87	86.8	88	87.2	85	87	86.8	175	72 ^{H6}	+0.019 0
1 MR 240 D-A087	200	122						125			215	71.8 ^{t6}	+0.094 +0.075
1 MR 240 F-A087	250	172						175			265	71.8 ^{H6}	+0.019 0
1 MR 240 H-A087	320	242						245			335	Fit	Dim.

MaßblattEN_1MR2402.EPS

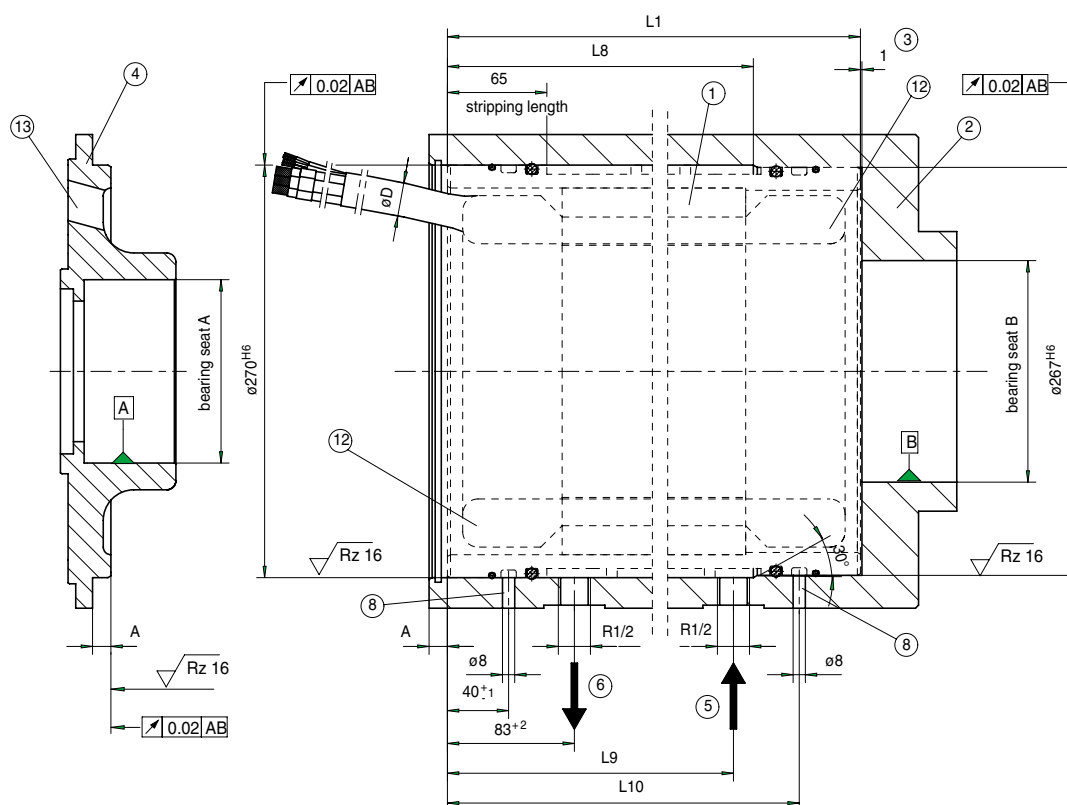
Fig. 5-22: Dimensions sheet Rotor 1MR240 (2/2)

Stator 1MS240



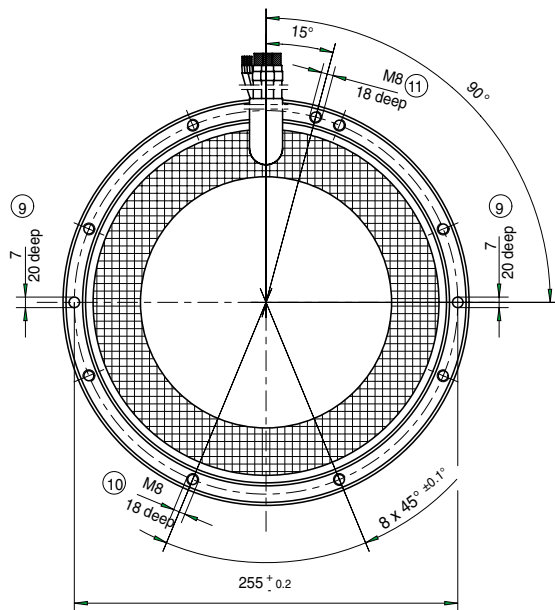
Mounting drill hole:

for axial mounting of the stator to the end shield



MaßblattEN_1MS2401.EPS

Fig. 5-23: Dimensions sheet 1MS240 (1/2)

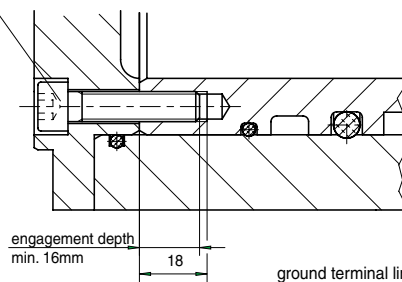


- ① Stator 1 MS 240...
- ② Spindle housing
- ③ Minimum clearance for expansion
- ④ end shield
- ⑤ Coolant flow thread as per DIN 2999 anywhere on circumference
- ⑥ Coolant drain flow as per DIN 2999 anywhere on circumference
- ⑦ Leakage groove
- ⑧ Leakage drill hole
- ⑨ ⑩ ⑪ on either stator end
- ⑫ End winding
Minimum clearance to housing 5 mm
- ⑬ Cable leadthrough with rounded edges

Type	Dim.	L1	L8 ⁺¹	L9 ⁻²	L10 ^{±1}	motor winding	
						øD	bend radius
1 MS 240 B-4A	270	201	187	230	20	70	
1 MS 240 D-4A	310	241	227	270			
1 MS 240 F-4A	360	291	277	320	22	90	
1 MS 240 H-4A	430	361	347	390			
1 MS 240 H-4B							

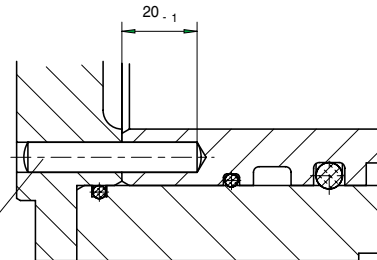
⑩ Axial mounting to end shield

Allen screw
DIN 912 M8
strength class
12.9
tensile strength
min. 1200 N/mm²
tightening torque
25 ÷ 30 Nm
secure with
Loctite 243



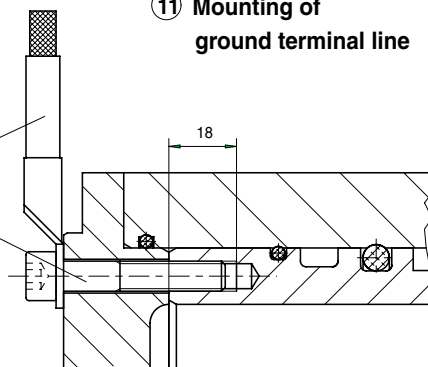
ground terminal line
(must be ordered
separately)
mounting screw M8
(must be ordered
separately)
Material: brass

⑨ Secure against movements on shield end



Cylindrical pin DIN 6325 ø8m6
Material: tensile strength min. 600 N/mm²
hardened, hardness 60 ± 2 HRC

⑪ Mounting of ground terminal line



MaßblattEN_1MS2402.EPS

Fig. 5-24: Dimensions sheet 1MS240 (2/2)

5.5 Dimensions sheet 1MB241

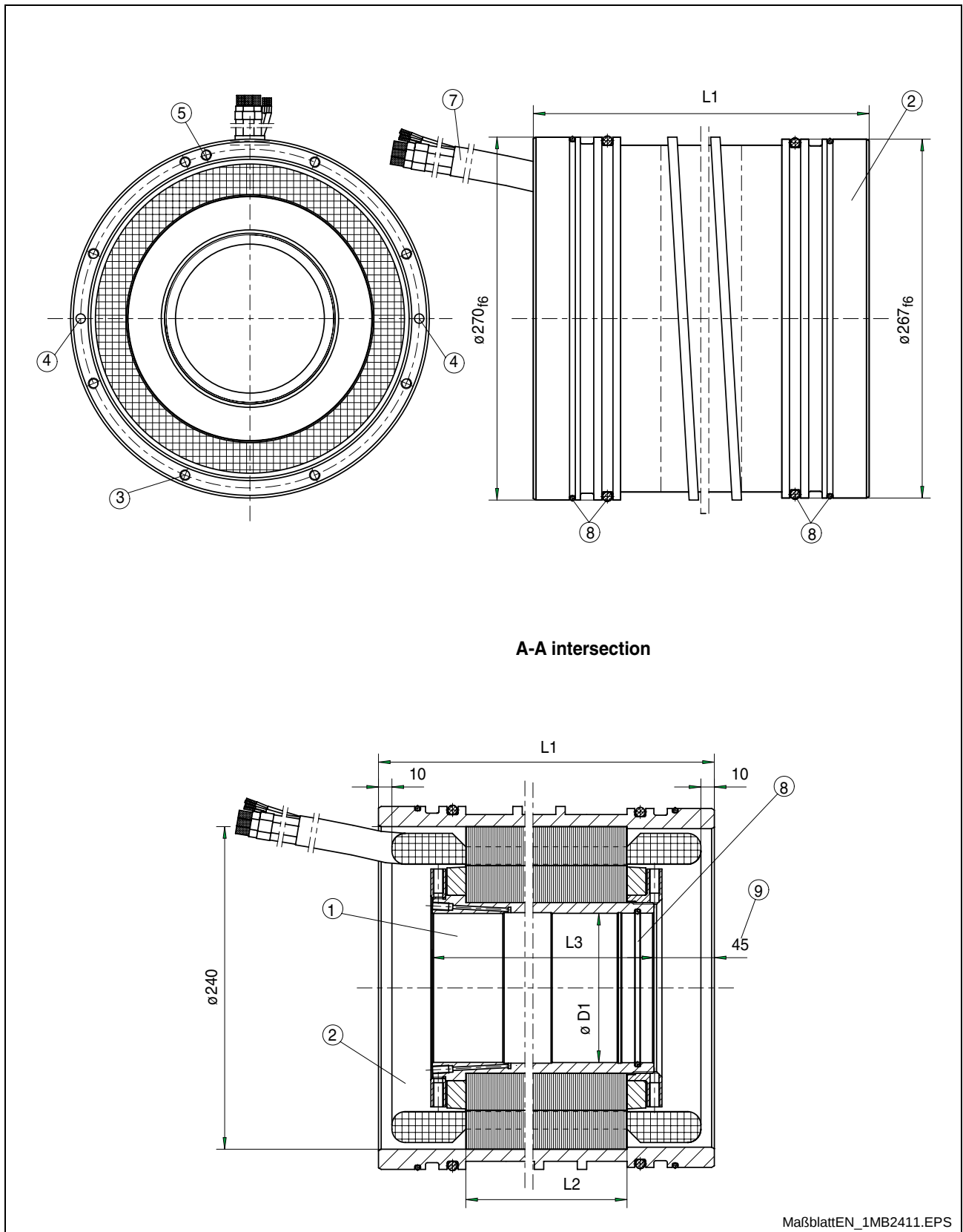
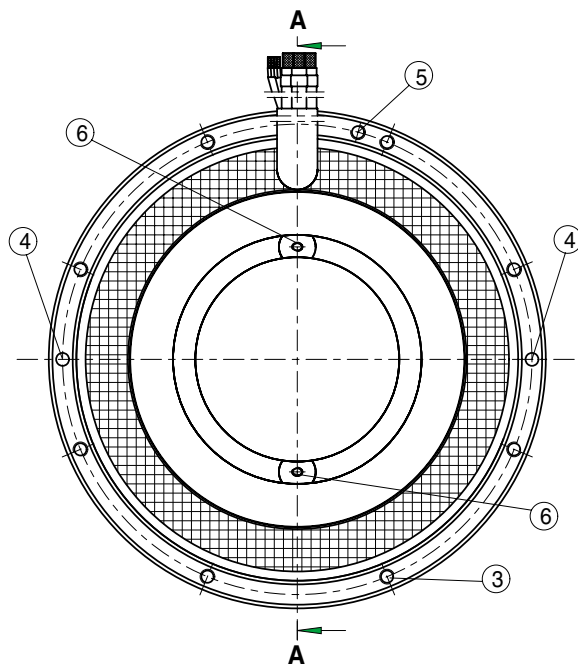


Fig. 5-25: Dimensions sheet 1MB241 (1/2)



- ① Rotor 1MR 241...
- ② Stator 1MS 241...
- ③ 8x M8 thread for axial mounting to spindle housing
- ④ ø7 drill hole for cylindrical pin for securing against movements with respect to spindle housing
- ⑤ M8 thread for mounting the ground terminal connection
- ⑥ Pressure oil connection for step interference fit
- ⑦ motor winding length 1500 mm
- ⑧ O-ring made of Viton
- ⑨ Positional dimension of rotor to stator

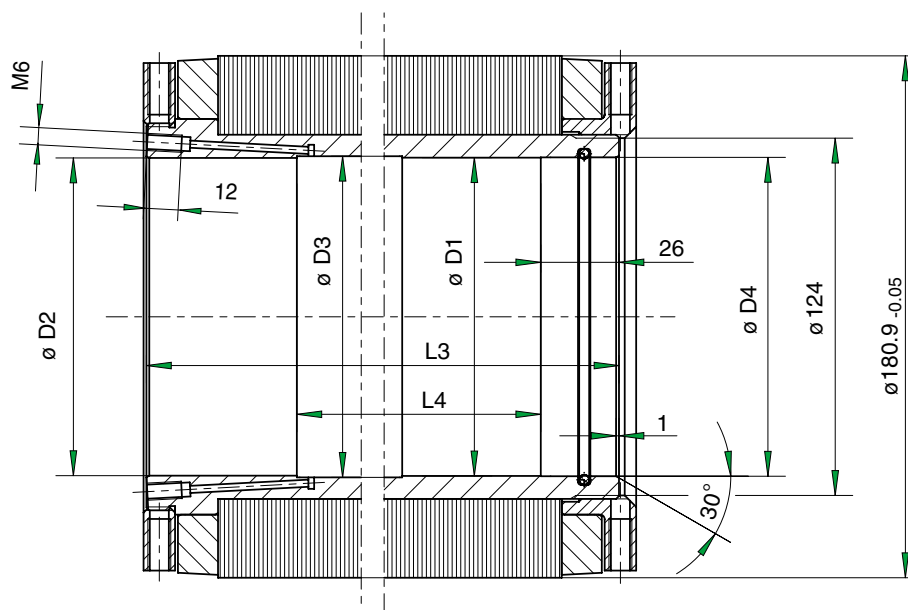
Dim. Type	$\varnothing D 1^{H6}$		L 1	L 2	L 3
1 MB 241 D	98	111	290	160	205
1 MB 241 H			410	280	325

MaßblattEN_1MB2412.EPS

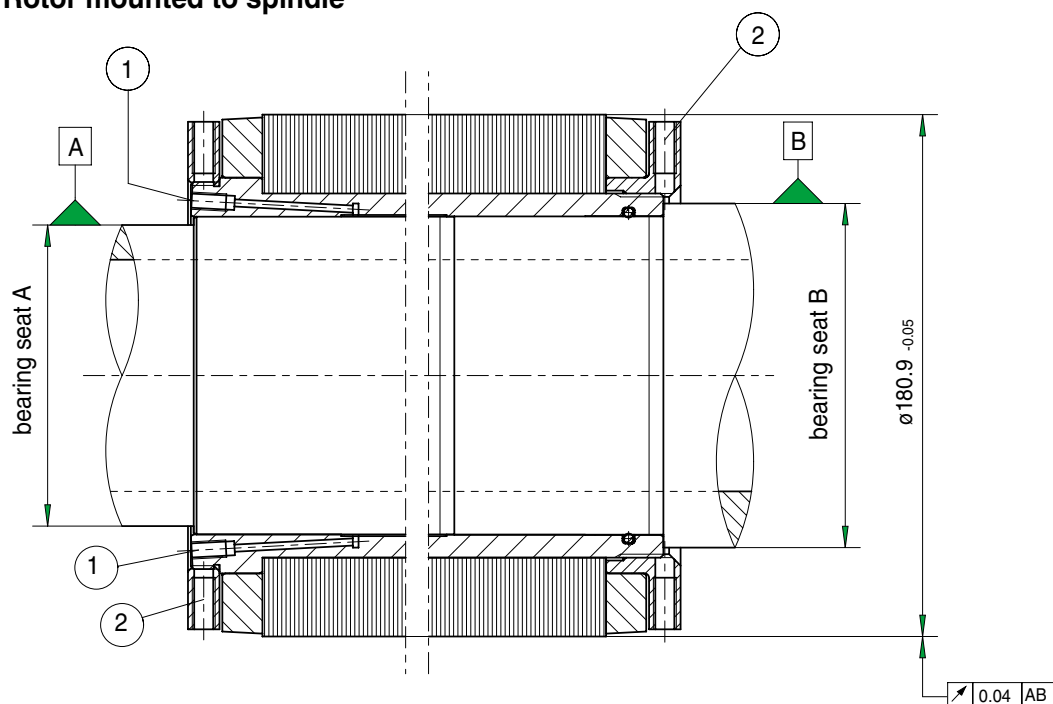
Fig. 5-26: Dimensions sheet 1MB241 (2/2)

Rotor - 1MR241

Rotor 1 MR 241... (condition at delivery)



Rotor mounted to spindle



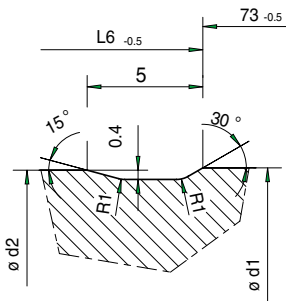
- ① Pressure oil connection
Sealed with threaded pin per DIN 913 after rotor is mounted
Secure threaded pins by bonding with LOCTITE 620

- ② Balancing ring with M8 thread
Threaded pins per DIN 913 for equilibrium when balancing
Secure the threaded pins by bonding with LOCTITE 620

Threaded pins ① ②
are part of general delivery

MaßblattEN_1MR2411.EPS

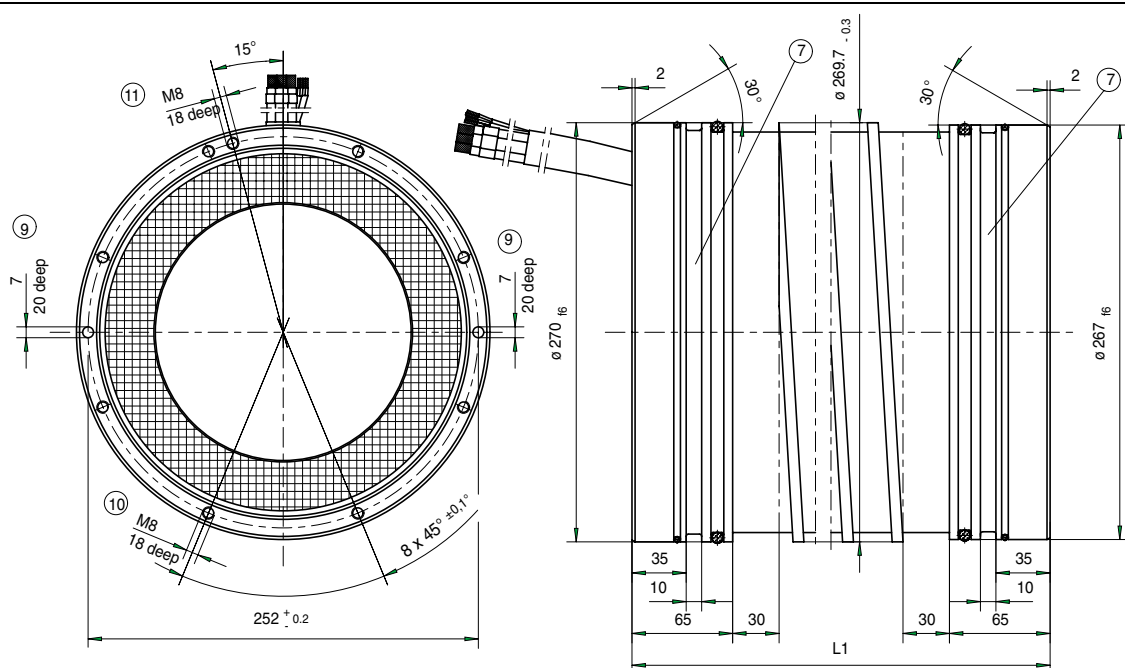
Fig. 5-27: Dimensions sheet Rotor 1MR241 (1/2)



Type \ Dim.	Rotor						Spindle				110.8 ^{H6}	+0.022 0
	L3	L4	ø D1 ^{H6}	ø D2 ^{H6}	ø D3	ø D4	L6 ^{-0.5}	ø d1 _{s6}	ø d2 _{t6}	L11	98 _{s6}	+0.093 +0.071
1 MR 241 D-A098	205	127	98	97.8	99	98.2	130	98	97.8	209	98 ^{H6}	+0.022 0
1 MR 241 H-A098	325	247					250			329	97.8 _{t6}	+0.113 +0.091
1 MR 241 D-A111	205	127	111	110.8	112	111.2	130	111	110.8	209	97.8 ^{H6}	+0.022 0
1 MR 241 H-A111	325	247					250			329	Fit	Dim.

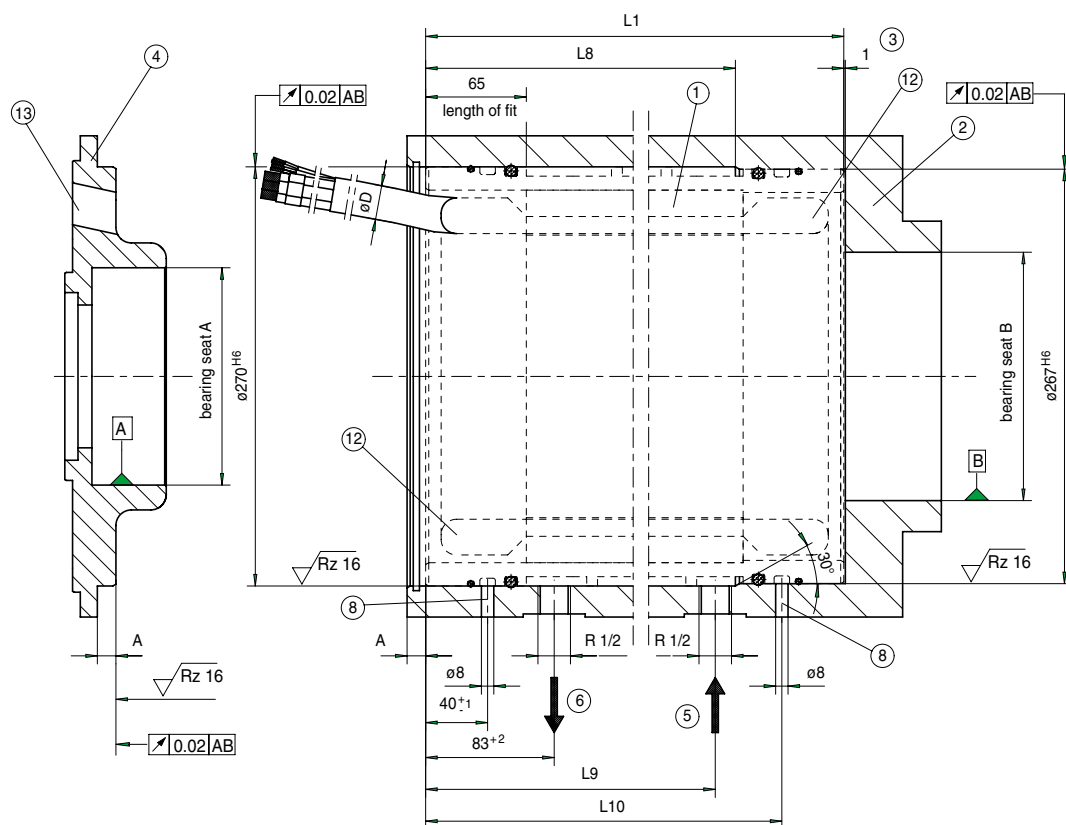
Fig. 5-28: Dimensions sheet Rotor 1MR241 (2/2)

Stator 1MS241



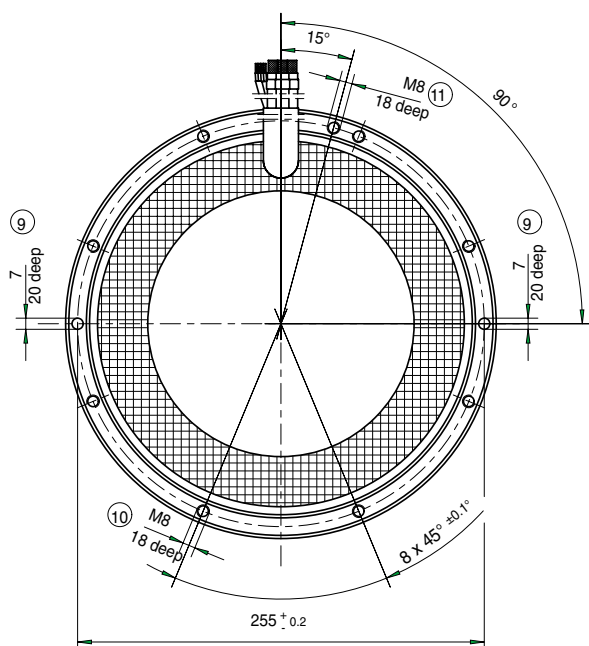
Mounting drill hole:

for axial mounting of the stator to the end shield



MaßblattEN_1MS2411.EPS

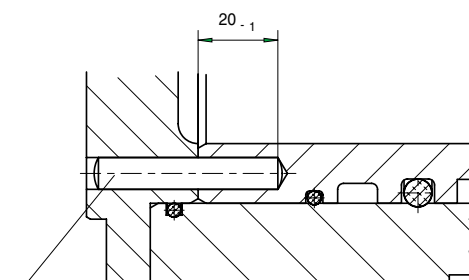
Fig. 5-29: Dimensions sheet 1MS241 (1/2)



- ① Stator 1 MS 241...
- ② Spindle housing
- ③ Minimum clearance for expansion
- ④ End shield
- ⑤ Coolant feed thread per DIN 2999 anywhere on circumference
- ⑥ Coolant drain thread as per DIN 2999 anywhere on circumference
- ⑦ Leakage groove
- ⑧ Leakage drill hole
- ⑨ ⑩ ⑪ on either end of stator
- ⑫ End winding
Minimum clearance to housing at least 5 mm
- ⑬ Cable leadthrough with rounded edges

Type	Dim.	L1	L8 ⁺¹	L9 ⁻²	L10 ⁺¹	motor winding	
						øD	bend radius
1 MS 241 D-6A	290	221	207	250	20	70	
1 MS 241 H-6C	410	341	327	370	22	90	
1 MS 241 H-6D							

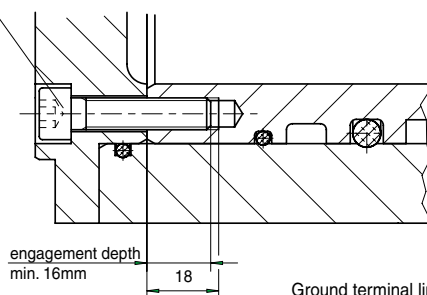
⑨ Secure against movements on end shield



Cylindrical pins DIN 6325 ø8 m6
Material: tensile strength min. 600 N/mm²
hardened, hardness 60 ± 2 HRC

⑩ Axial mounting to end shield

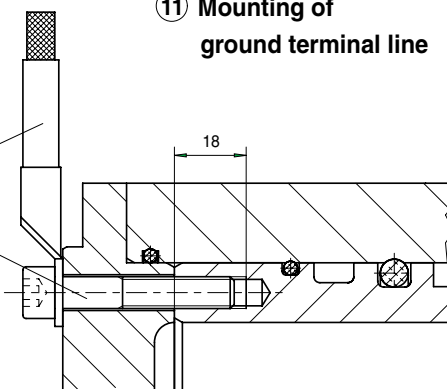
Allen screw
DIN 912 M8
strength class
12.9
tensile strength
min. 1200 N/mm²
tightening torque
25 ÷ 30 Nm
secured with
Loctite 243



Ground terminal line
(must be ordered
separately)

Mounting screw M8
(must be ordered
separately)
Material: brass

⑪ Mounting of ground terminal line



MaßblattEN_1MS2412.EPS

Fig. 5-30: Dimensions sheet 1MS241 (2/2)

5.6 Dimensions sheet 1MB242

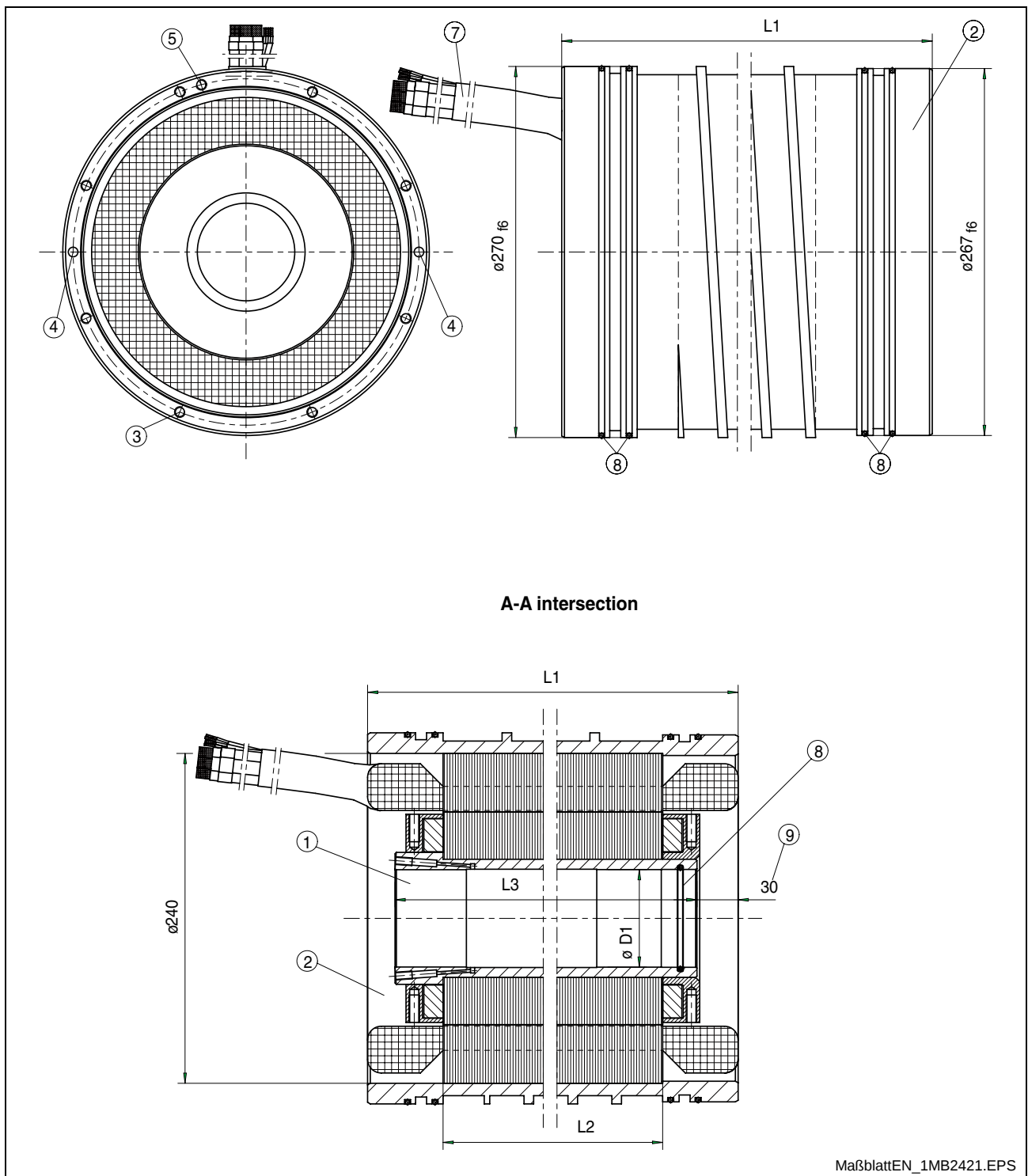
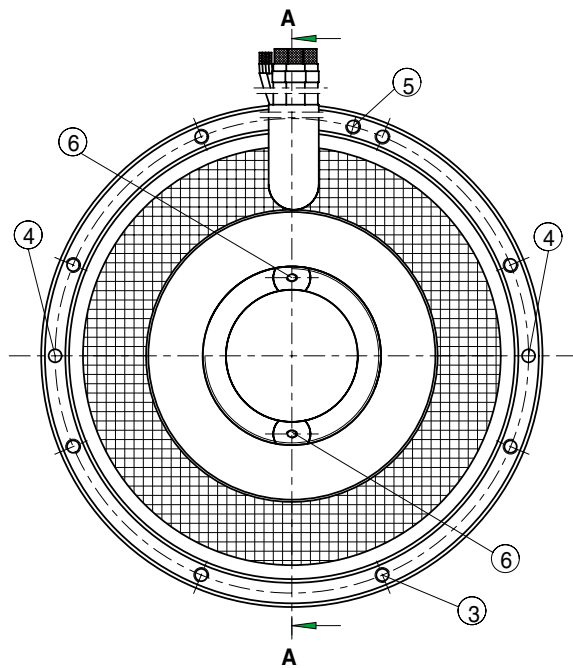


Fig. 5-31: Dimensions sheet 1MB242 (1/2)



- ① Rotor 1MR 242...
- ② Stator 1MS 242...
- ③ 8x M8 thread for axial mounting to spindle housing
- ④ ø7 drill hole for cylindrical pins for securing against movements with respect to spindle housing
- ⑤ M8 thread for mounting ground terminal
- ⑥ Pressure oil connection step interference fit
- ⑦ motor winding 1500 mm long
- ⑧ O-ring made of Viton
- ⑨ Positional dimension of rotor to stator

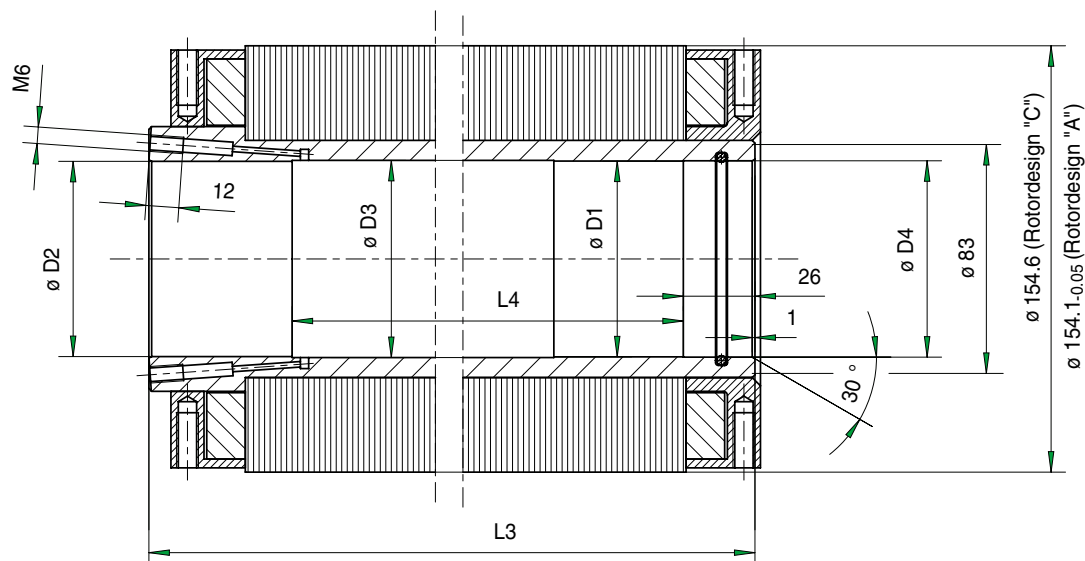
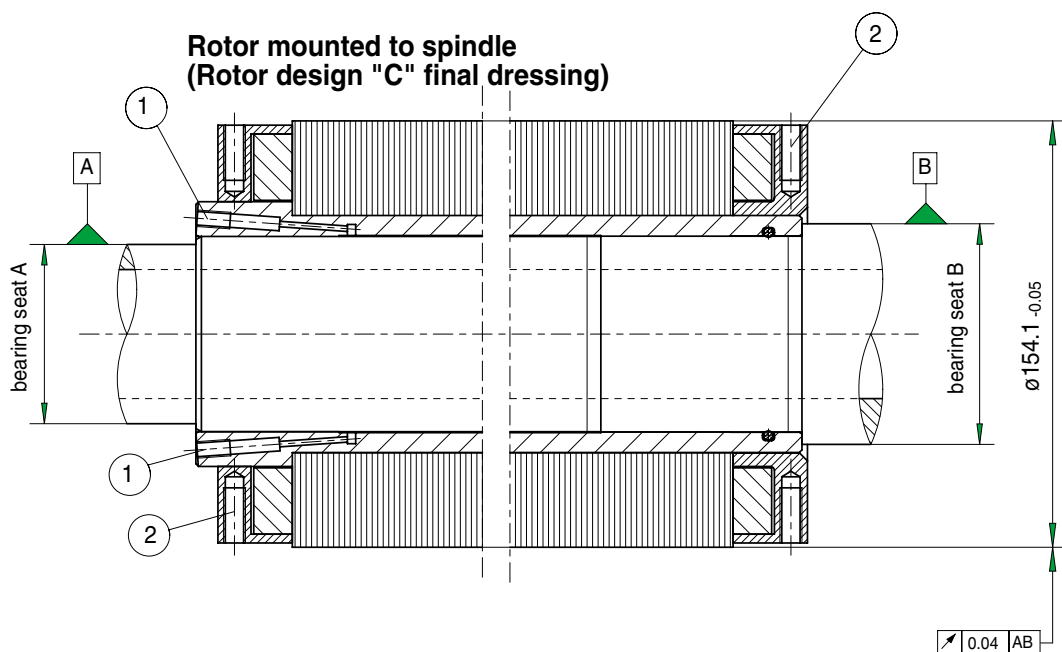
Dim. Type	ø D 1 ^{H6}	L 1	L 2	L 3
1 MB 242 N	71	440	330	390

MaßblattEN_1MB2422.EPS

Fig. 5-32: Dimensions sheet 1MB242 (2/2)

Rotor - 1MR242

Rotor 1 MR 242... (condition at delivery)

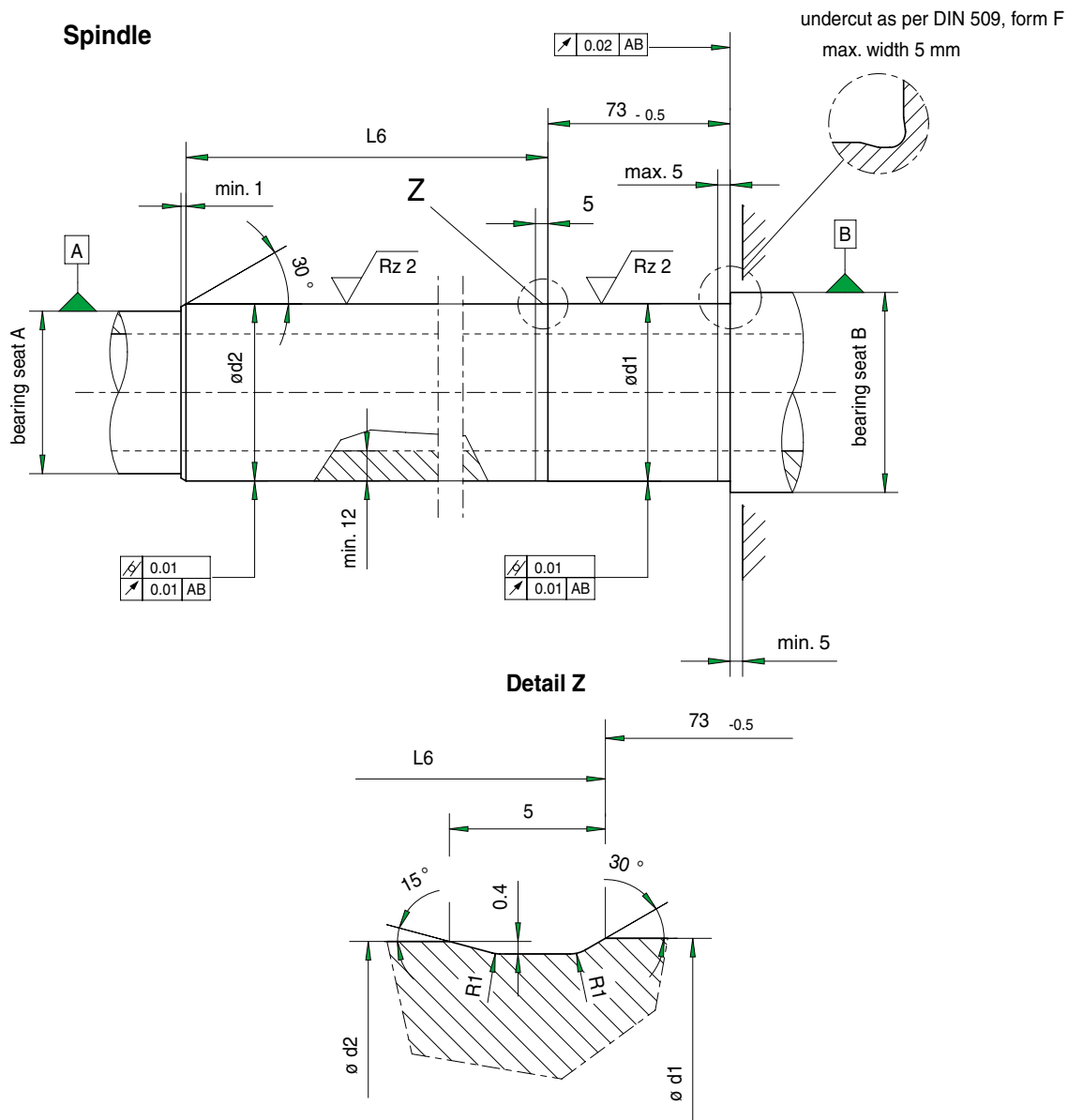
Rotor mounted to spindle
(Rotor design "C" final dressing)

- ① Pressure oil connection
Sealed with threaded pins per DIN 913 after rotor is mounted
Secure the threaded pins by bonding with LOCTITE 620
- ② Balance ring with M6 or M8 thread
Threaded pins per DIN 913 for equilibrium when balancing
Secure the threaded pins by bonding with LOCTITE 620

Threaded pins for ① ②
are general part of order.

MaßblattEN_1MR2421.EPS

Fig. 5-33: Dimensions sheet Rotor 1MR242 (1/2)



Type	Dim.	Rotor						Spindle				
		L3	L4	ø D1 H6	ø D2 H6	ø D3	ø D4	L6 -0.5	ød1 s6	ød2 t6		
1 MR 242 N-x071		390	312	71	70.8	72	71.2	315	71	70.8	Fit	Dim.

x = Rotor design "A" or "C"

MaßblattEN_1MR2422.EPS

Fig. 5-34: Dimensions sheet Rotor 1MR242 (2/2)

Stator 1MS242

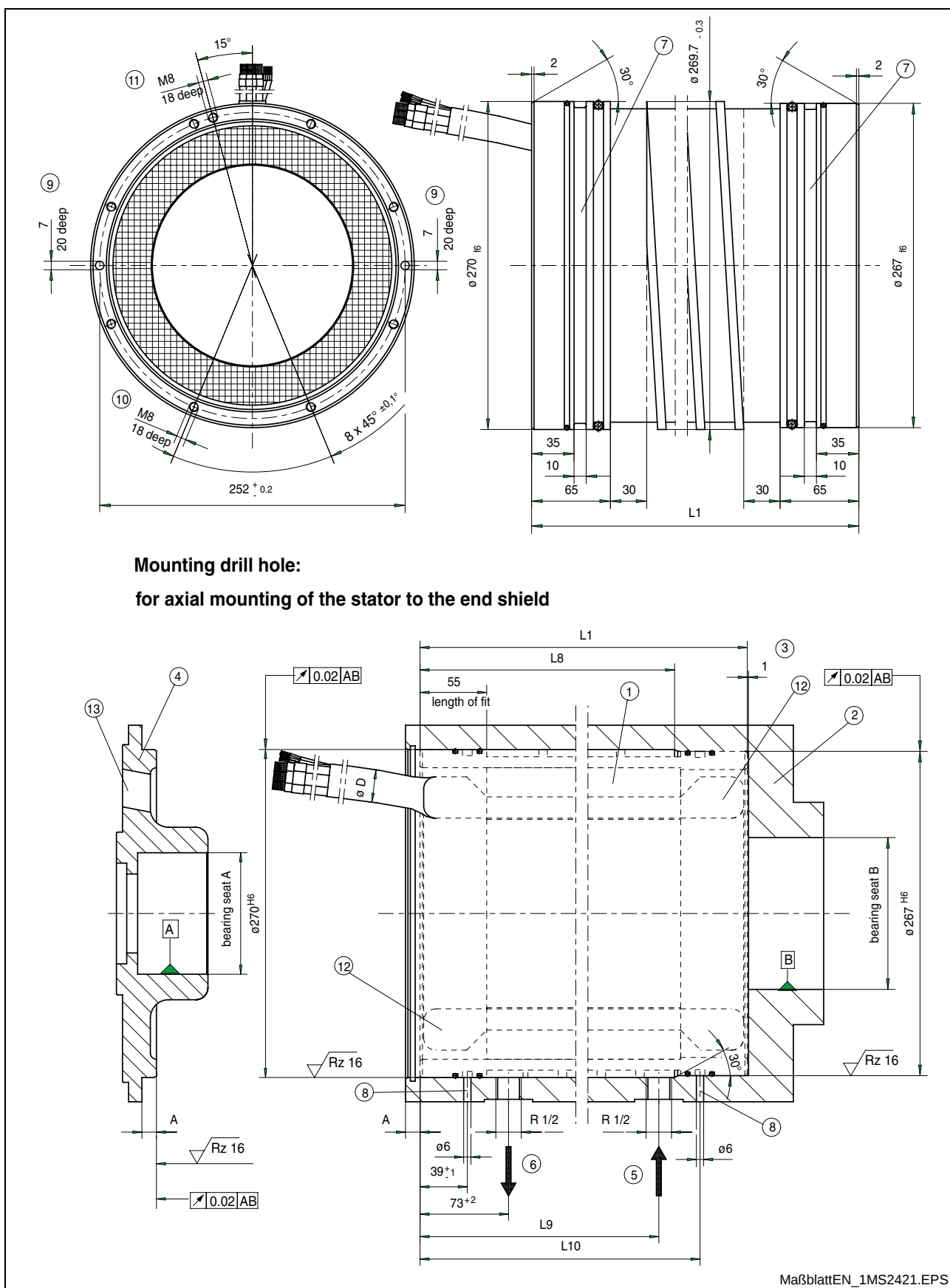
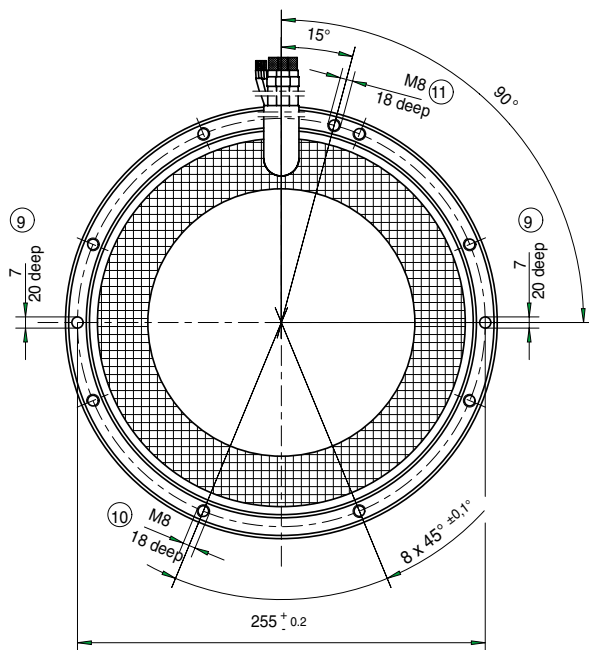


Fig. 5-35: Dimensions sheet 1MS242 (1/2)

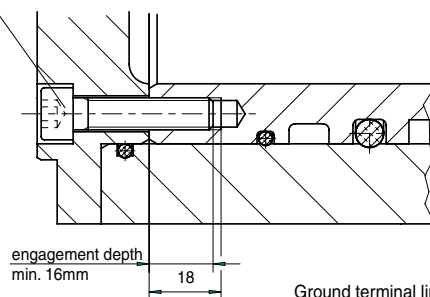


- ① Stator 1 MS 242...
- ② Spindle housing
- ③ Minimum clearance for expansion
- ④ end shield
- ⑤ Coolant feed thread DIN 2999 anywhere on circumference
- ⑥ Coolant drain thread DIN 2999 anywhere on circumference
- ⑦ Leakage groove
- ⑧ Leakage drill hole
- ⑨ ⑩ ⑪ on either end of stator
- ⑫ End winding
Minimum clearance of 5 mm to housing
- ⑬ Cable leadthrough with rounded edges

Type	Dim.	L1	L8 ⁺¹	L9 ⁻²	L10 ⁺¹	motor winding	
						øD	bend radius
1 MS 242 N-4B		440	381	367	401	27	110

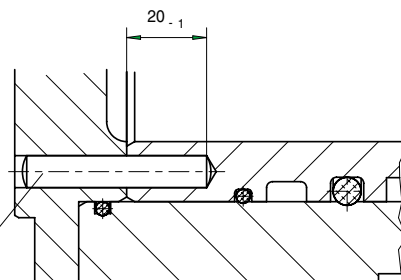
⑩ Axial mounting to end shield

Allen screw
DIN 912 M8
strength class
12.9
tensile strength
min. 1200 N/mm²
tightening torque
25 ÷ 30 Nm
secure with
Loctite 243



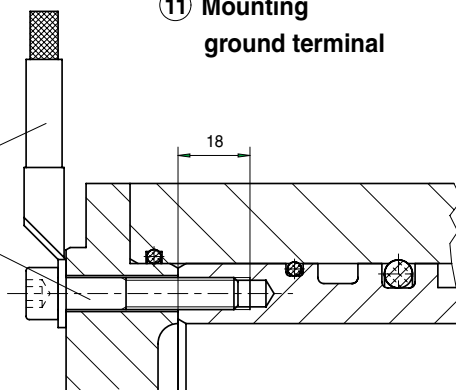
Ground terminal line
(must be ordered
separately)
Mounting screw M8
(must be ordered
separately)
Material: brass

⑨ Secure against movements on end shield



Cylindrical pins DIN 6325 ø8^{m6}
Material: Tensile strength min. 600 N/mm²
hardened, hardness 60 ± 2 HRC

⑪ Mounting ground terminal



MaßblattEN_1MS2422.EPS

Fig. 5-36: Dimensions sheet 1MS242 (2/2)

5.7 Dimensions sheet 1MB270

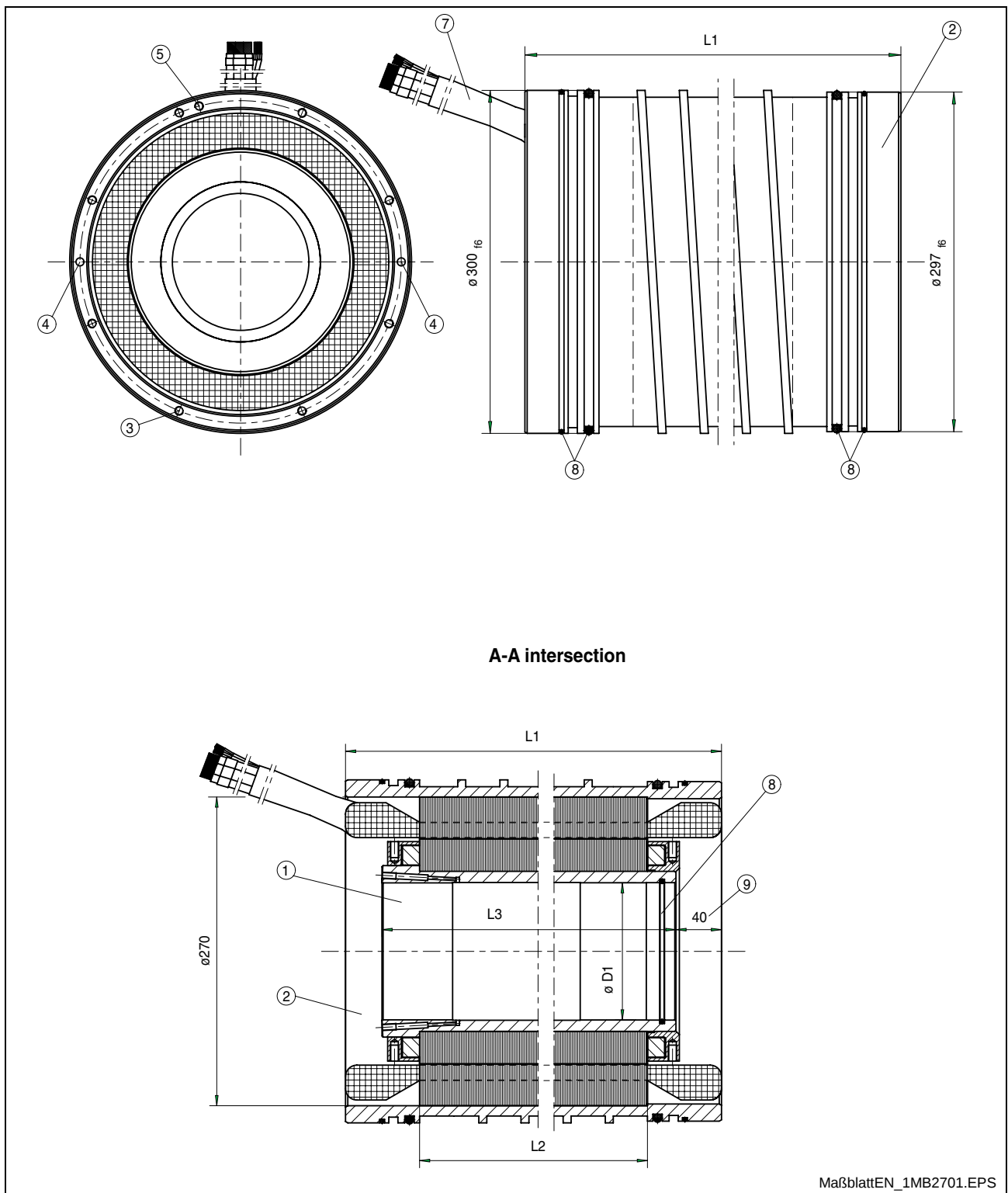
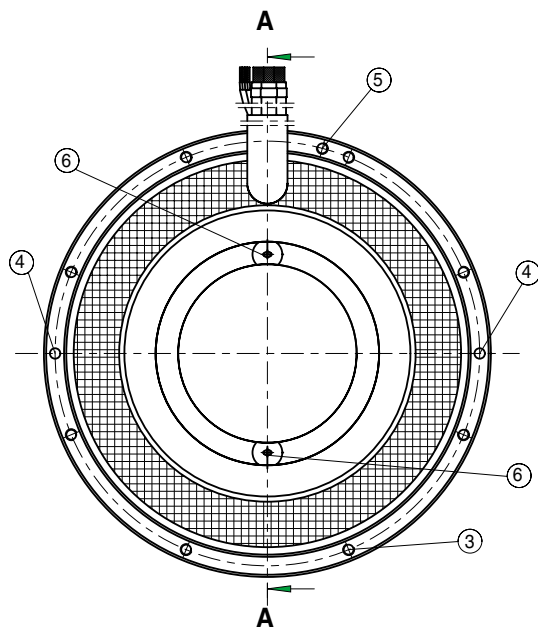


Fig. 5-37: Dimensions sheet 1MB270 (1/2)



- ① Rotor 1MR 270...
- ② Stator 1MS 270...
- ③ 8x M8 thread for axial mounting to spindle housing
- ④ ø7 drill hole for cylindrical pins for securing against movements with respect to the spindle housing
- ⑤ M8 thread for mounting the ground terminal
- ⑥ Pressure oil connection step interference fit
- ⑦ Motor winding length 1500 mm
- ⑧ O-ring made of Viton
- ⑨ Positional dimension of rotor to stator

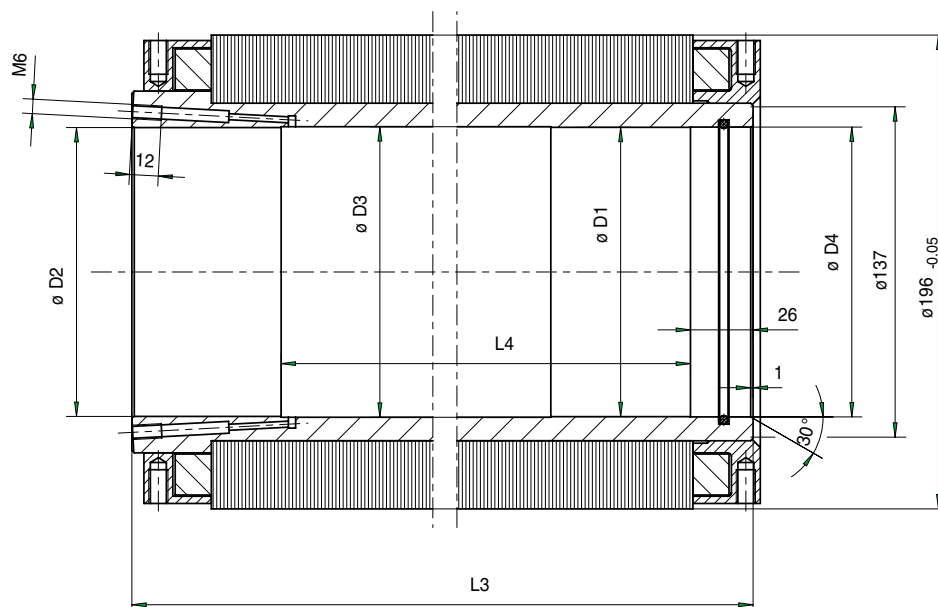
Dim. Type	$\varnothing D 1^{H6}$		L 1	L 2	L 3
1 MB 270 C	90	120	400	270	328

MaßblattEN_1MB2702.EPS

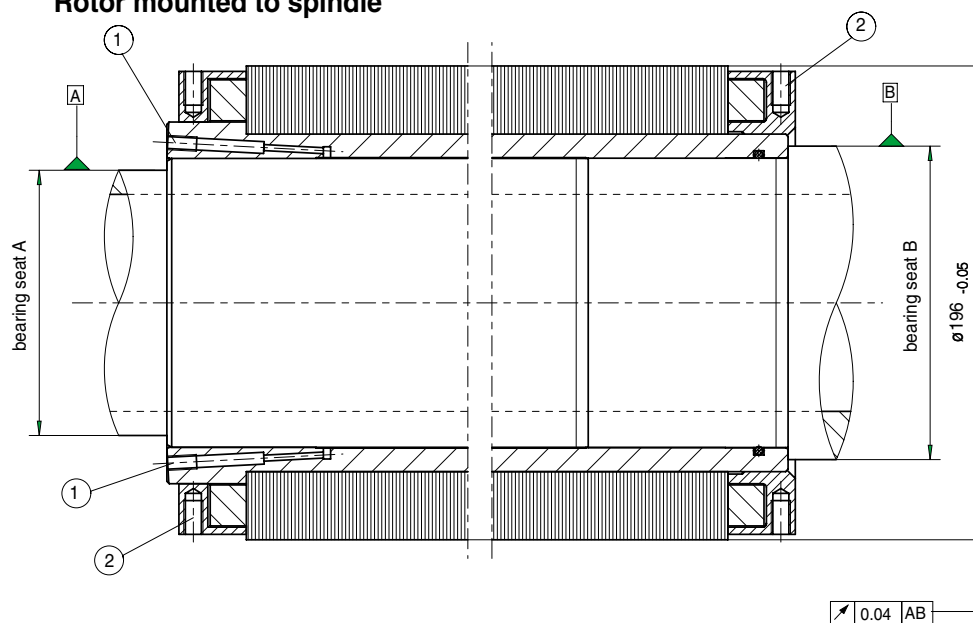
Fig. 5-38: Dimensions sheet 1MB270 (2/2)

Rotor - 1MR270

Rotor 1 MR 270... (condition at delivery)



Rotor mounted to spindle



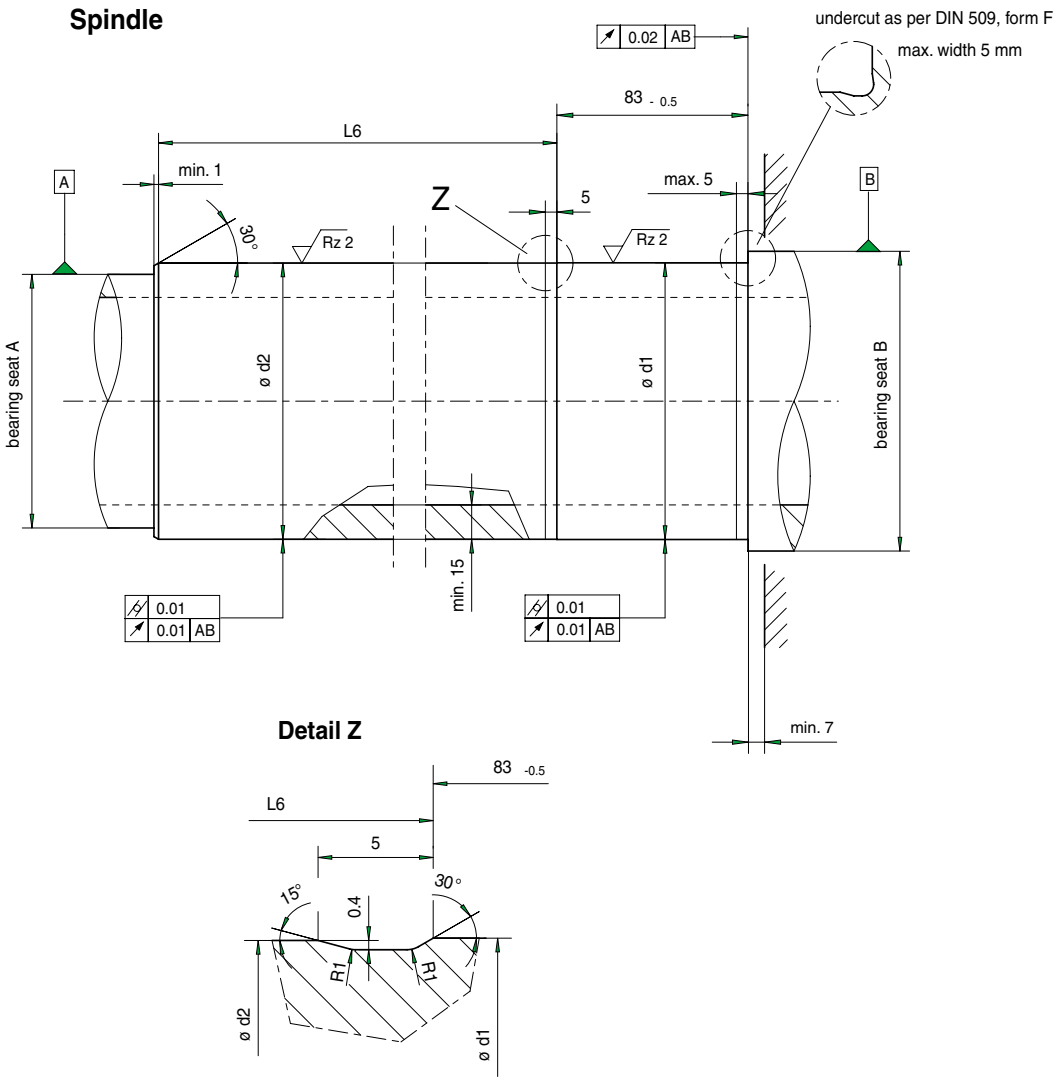
- ① Pressure oil connection
Sealed with threaded pins as per DIN 913 after mounting of rotor
Threaded pins bonded and secured with LOCTITE 620

- ② Balancing with M6 thread
Threaded pins as per DIN 913 for equilibrium when balancing
Threaded pins secured and bonded with LOCTITE 620

Threaded pins for ① ②
are part of delivery.

MaßblattEN_1MR2701.EPS

Fig. 5-39: Dimensions sheet Rotor 1MR270 (1/2)



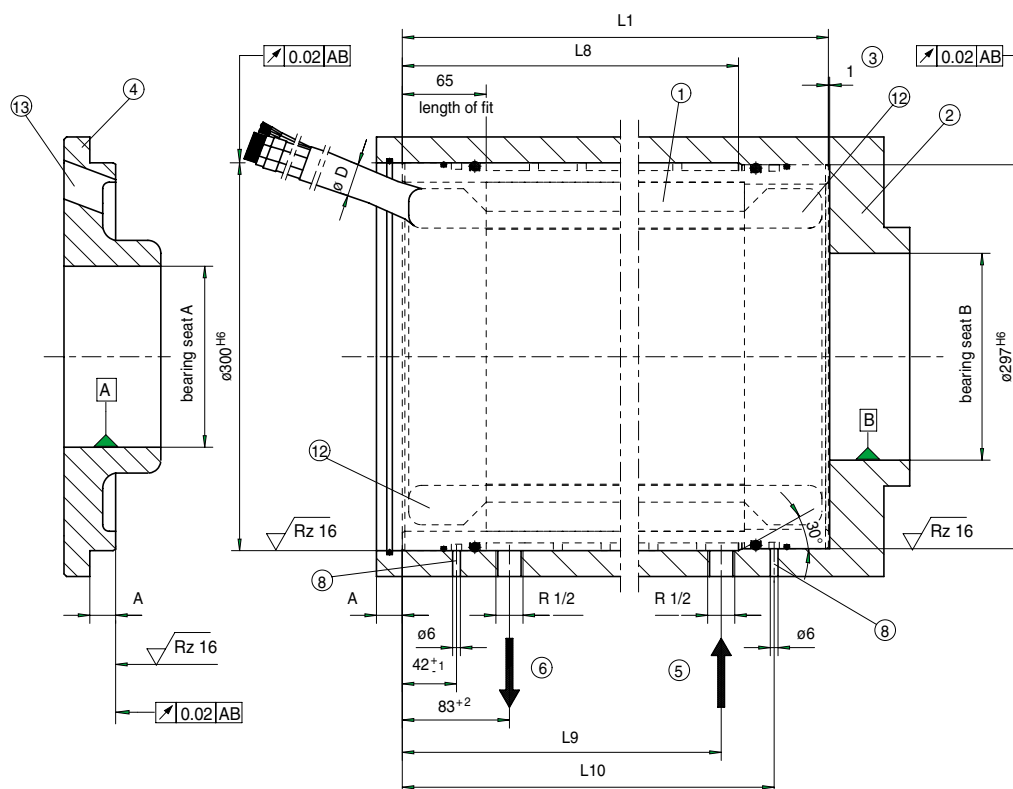
Type	Dim.	Rotor						Spindle		
		L3	L4	$\varnothing D1$ ^{H6}	$\varnothing D2$ ^{H6}	$\varnothing D3$	$\varnothing D4$	L6 _{-0.5}	$\varnothing d1$ _{s6}	$\varnothing d2$ _{t6}
1 MR 270 C-A090		328	240	90	89.8	91	90.2	243	90	89.8
1 MR 270 C-A120		328	240	120	119.8	121	120.2	243	120	119.8

120 _{s6}	+0.101 +0.079
120 ^{H6}	+0.022 0
119.8 _{t6}	+0.126 +0.104
119.8 ^{H6}	+0.022 0
90 _{s6}	+0.093 +0.071
90 ^{H6}	+0.022 0
89.8 _{t6}	+0.113 +0.091
89.8 ^{H6}	+0.022 0
Fit	Dim.

MaßblattEN_1MR2702.EPS

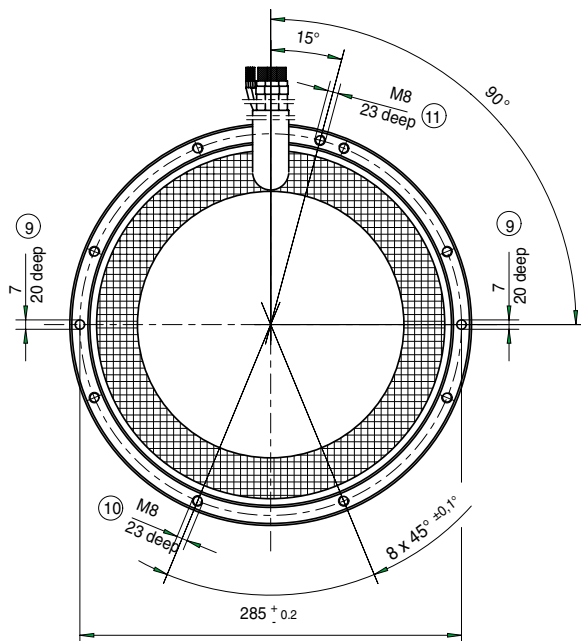
Fig. 5-40: Dimensions sheet Rotor 1MR270 (2/2)

for axial mounting of the stator to end shield



MaßblattEN_1MS2701.EPS

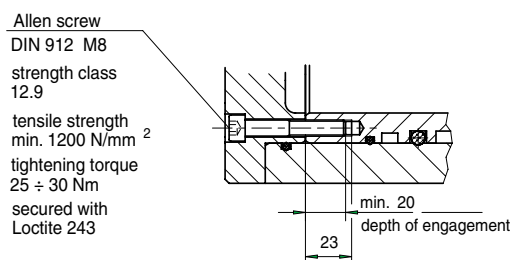
Fig. 5-41: Dimensions sheet 1MS270 (1/2)



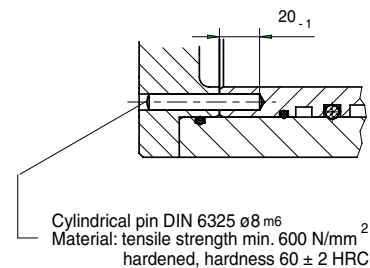
- ① Stator 1 MS 270...
- ② Spindle housing
- ③ Minimum clearance for expansion
- ④ End shield
- ⑤ Coolant feed thread as per DIN 2999 anywhere on circumference
- ⑥ Coolant drain thread as per DIN 2999 anywhere on circumference
- ⑦ Leakage groove
- ⑧ Leakage drill hole
- ⑨ ⑩ ⑪ on either stator end
- ⑫ End winding
Clearance to housing min. 5 mm
- ⑬ Cable leadthrough with rounded edges

Type	Dim.	L1	L8 ⁺¹	L9 ⁻²	L10 ^{±1}	motor winding	
						øD	bend radius
1 MS 270 C-4B	400	331	317	358	27	110	

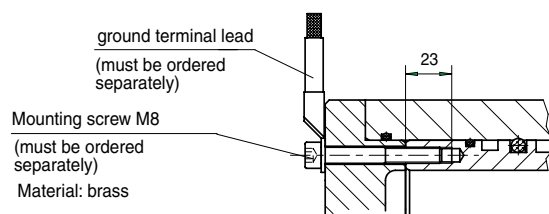
⑩ Axial mounting to end shield



⑨ Secure against movements on end shield



⑪ Mounting of ground terminal lead



MaßblattEN_1MS2702.EPS

Fig. 5-42: Dimensions sheet 1MS270 (2/2)

5.8 Dimensions sheet 1MB310

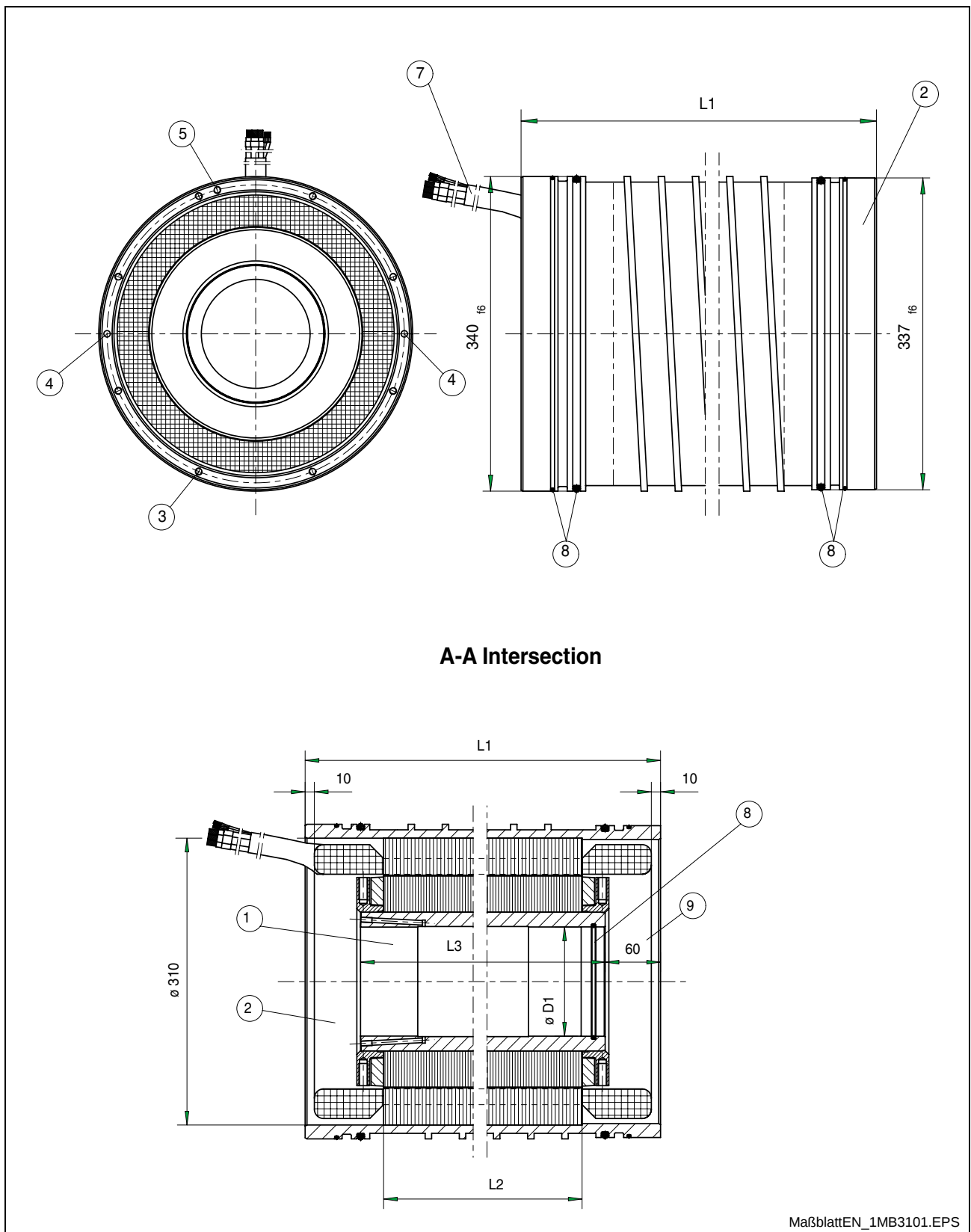
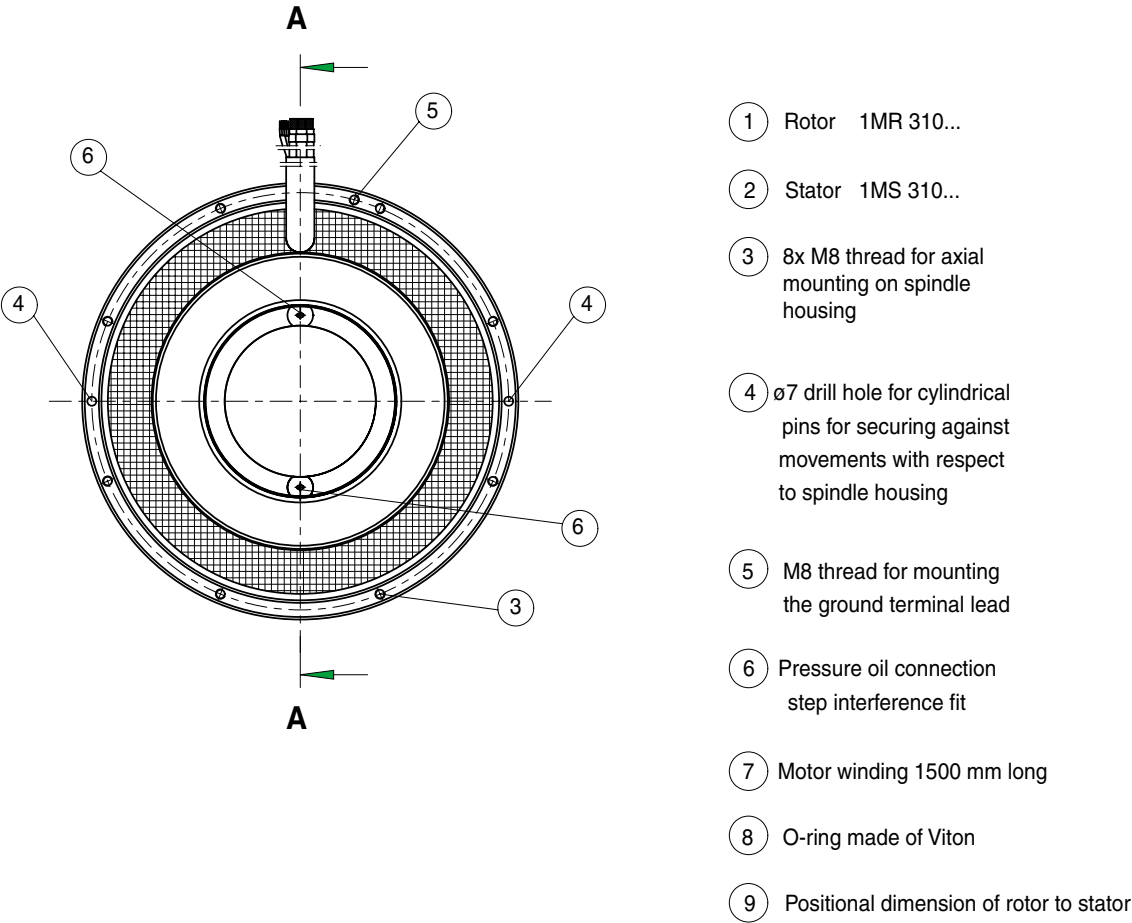


Fig. 5-43: Dimensions sheet 1MB310 (1/2)



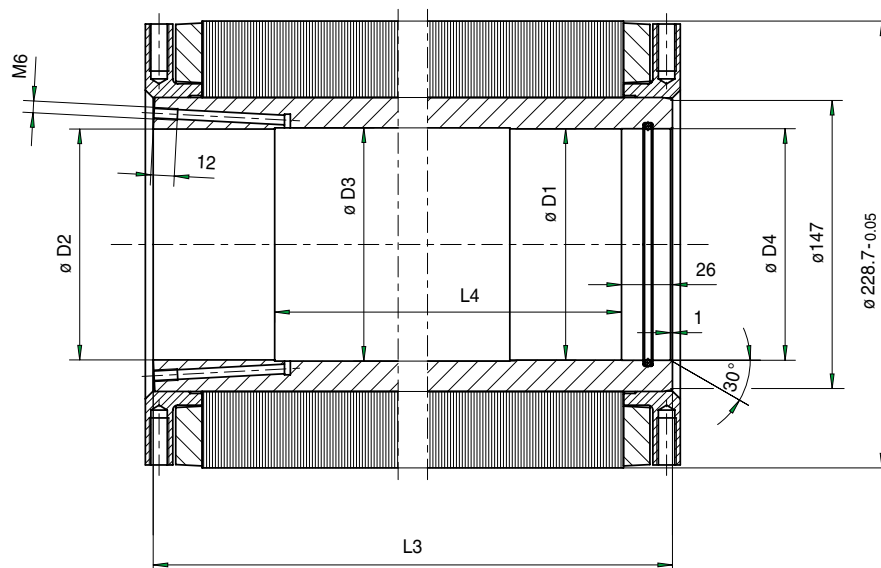
Dim. Type	ø D 1 ^{H6}						L 1	L 2	L 3
1 MB 310 B	94	108	112	118	120	125	385	215	265
1 MB 310 D							450	280	330
1 MB 310 F							520	350	400

MaßblattEN_1MB3102.EPS

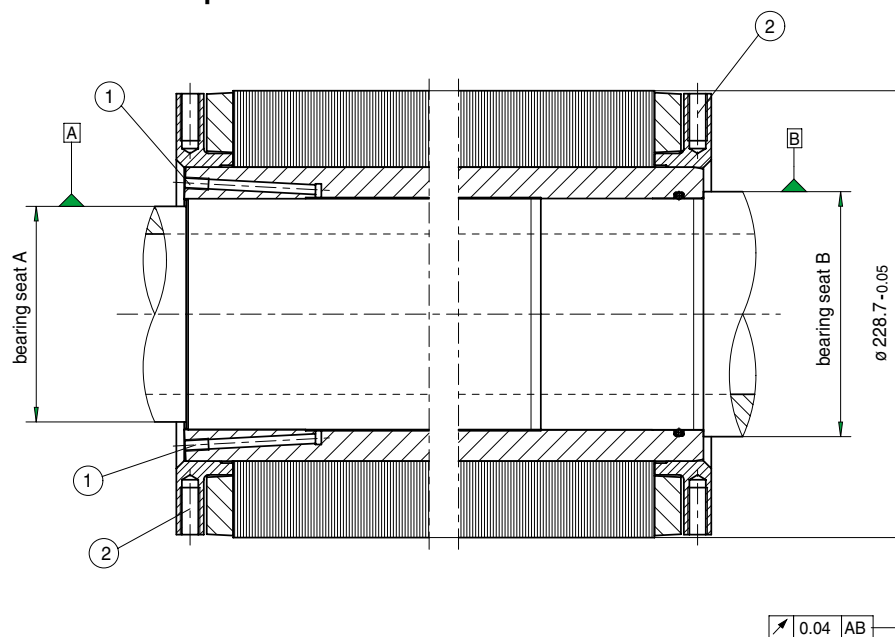
Fig. 5-44: Dimensions sheet 1MB310 (2/2)

Rotor - 1MR310

Rotor 1 MR 310... (condition at delivery)



Rotor mounted to spindle



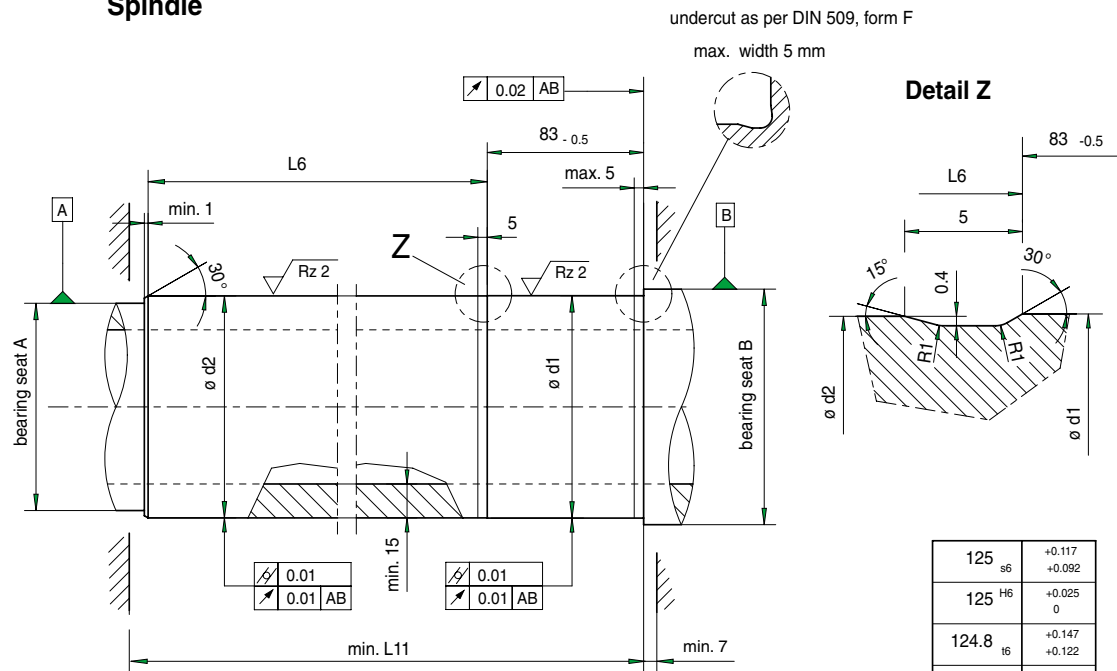
- 1 Pressure oil connection
Sealed with threaded pins as per DIN 913 after mounting of rotor
Threaded pins secured and bonded with LOCTITE 620
- 2 Balancing ring with M10 thread
Threaded pins per DIN 913 for equilibrium when balancing
Threaded pins secured and bonded with LOCTITE 620

Threaded pins for (1) (2)
are part of delivery.

MaßblattEN_1MR3101.EPS

Fig. 5-45: Dimensions sheet Rotor 1MR310 (1/2)

Spindle



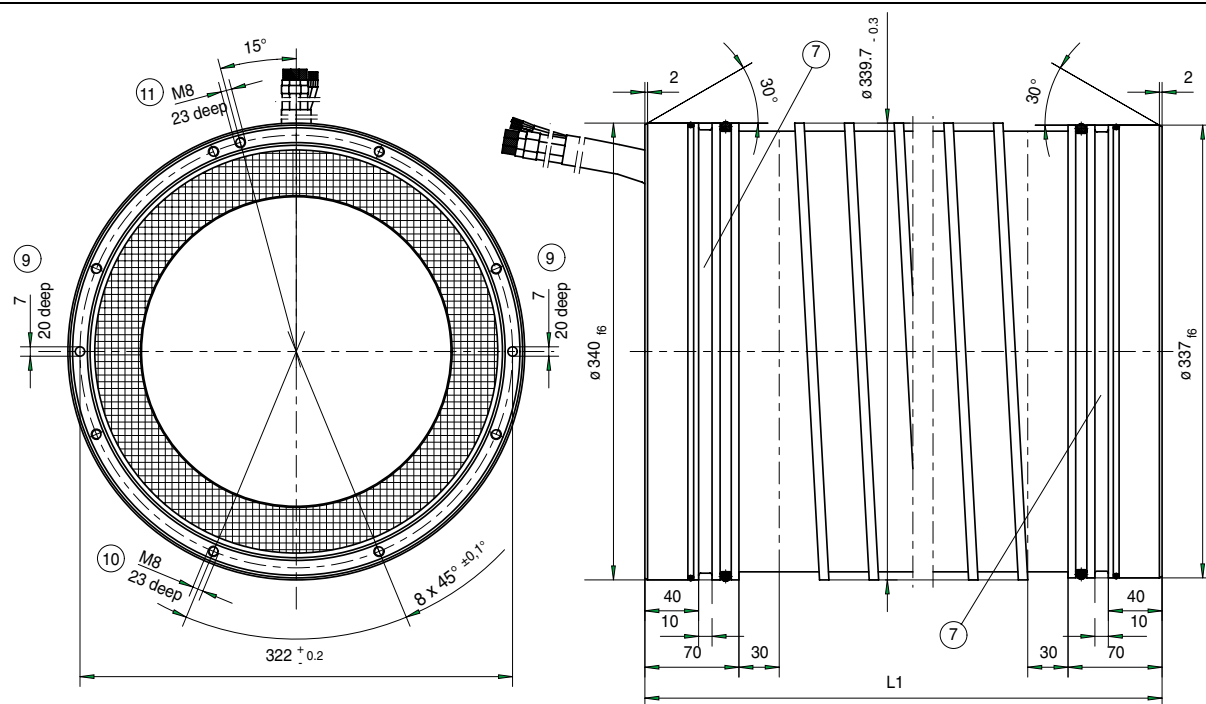
Type	Dim.	Rotor						Spindle			
		L3	L4	ø D1 H6	ø D2 H6	ø D3	ø D4	L6 -0.5	ø d1 s6	ø d2 t6	L11
1 MR 310 B-A094	265	177	94	93.8	95	94.2	180	245	94	93.8	273
1 MR 310 D-A094	330	242									338
1 MR 310 F-A094	400	312									408
1 MR 310 B-A108	265	177	108	107.8	109	108.2	180	245	108	107.8	273
1 MR 310 D-A108	330	242									338
1 MR 310 F-A108	400	312									408
1 MR 310 B-A112	265	177	112	111.8	113	112.2	180	245	112	111.8	273
1 MR 310 D-A112	330	242									338
1 MR 310 F-A112	400	312									408
1 MR 310 B-A118	265	177	118	117.8	119	118.2	180	245	118	117.8	273
1 MR 310 D-A118	330	242									338
1 MR 310 F-A118	400	312									408
1 MR 310 B-A120	265	177	120	119.8	121	120.2	180	245	120	119.8	273
1 MR 310 D-A120	330	242									338
1 MR 310 F-A120	400	312									408
1 MR 310 B-A125	265	177	125	124.8	126	125.2	180	245	125	124.8	273
1 MR 310 D-A125	330	242									338
1 MR 310 F-A125	400	312									408

125 s6	+0.117 +0.092 0
125 H6	+0.025 0
124.8 t6	+0.147 +0.122 0
124.8 H6	+0.025 0
120 s6	+0.101 +0.079 0
120 H6	+0.022 0
119.8 t6	+0.126 +0.104 0
119.8 H6	+0.022 0
118 s6	+0.101 +0.079 0
118 H6	+0.022 0
117.8 t6	+0.126 +0.104 0
117.8 H6	+0.022 0
112 s6	+0.101 +0.079 0
112 H6	+0.022 0
111.8 t6	+0.126 +0.104 0
111.8 H6	+0.022 0
108 s6	+0.101 +0.079 0
108 H6	+0.022 0
107.8 t6	+0.126 +0.104 0
107.8 H6	+0.022 0
94 s6	+0.093 +0.071 0
94 H6	+0.022 0
93.8 t6	+0.113 +0.091 0
93.8 H6	+0.022 0
Fit	Dim.

MaßblattEN_1MR3102.EPS

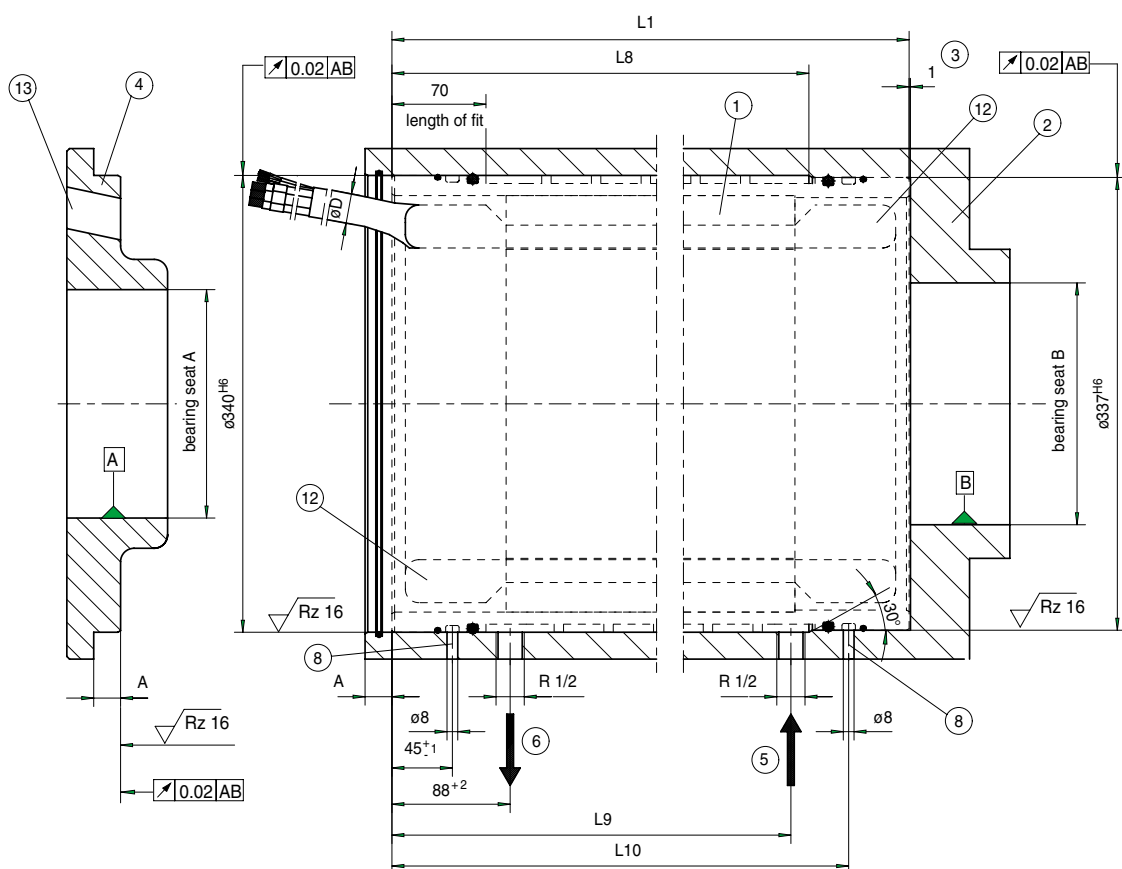
Fig. 5-46: Dimensions sheet Rotor 1MR310 (2/2)

Stator 1MS310



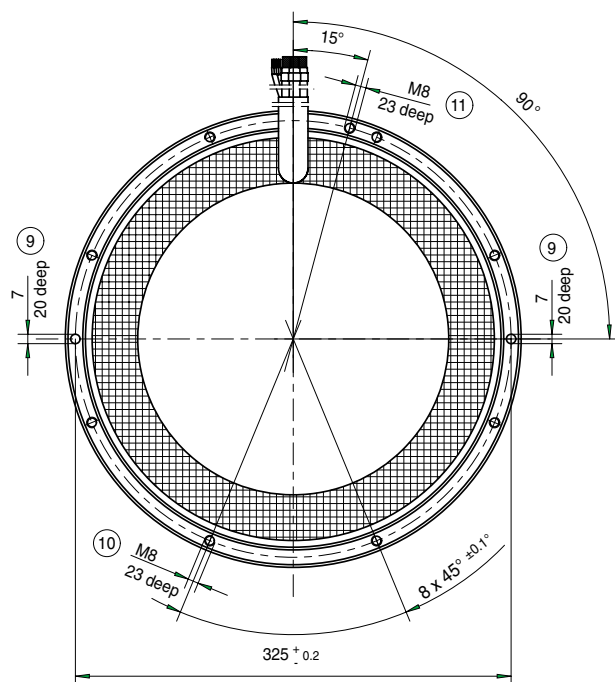
Mounting drill hole:

for axial mounting of the stator to the end shield



MaßblattEN 1MS3101.EPS

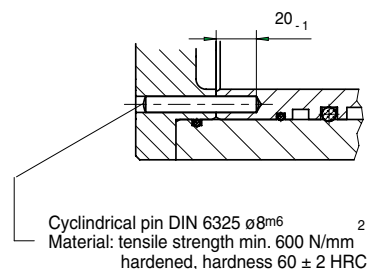
Fig. 5-47: Dimensions sheet 1MS310 (1/2)



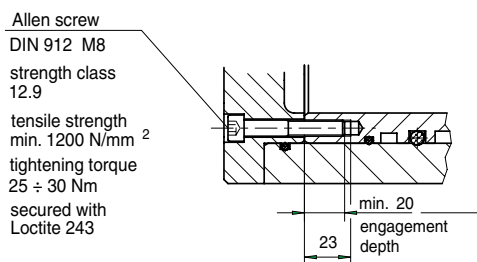
- ① Stator 1 MS 310...
- ② Spindle housing
- ③ Minimum clearance for expansion
- ④ End shield
- ⑤ Coolant feed thread as per DIN 2999 anywhere on circumference
- ⑥ Coolant drain thread as per DIN 2999 anywhere on circumference
- ⑦ Leakage groove
- ⑧ Leakage drill hole
- ⑨ ⑩ ⑪ on either stator end
- ⑫ End winding
Clearance to housing min. 5 mm
- ⑬ cable leadthrough with rounded edges

Type	Dim.	L1	L8 +1	L9 -2	L10 ±1	Motor winding	
						øD	bend radius
1 MS 310 B-6B		385	311	297	340	22	90
1 MS 310 B-6D							
1 MS 310 B-6E							
1 MS 310 D-6B		450	376	362	405	27	110
1 MS 310 F-6B		520	446	432	475		

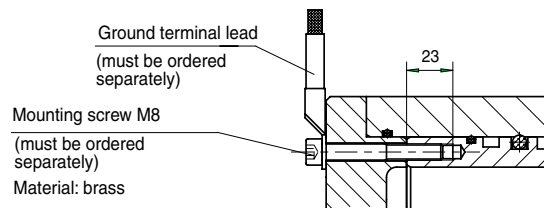
⑨ Secure against movements on end shield



⑩ Axial mounting to the end shield



⑪ Mounting ground terminal lead



MaßblattEN_1MS3102.EPS

Fig. 5-48: Dimensions sheet 1MS310 (2/2)

5.9 Dimensions sheet 1MB375

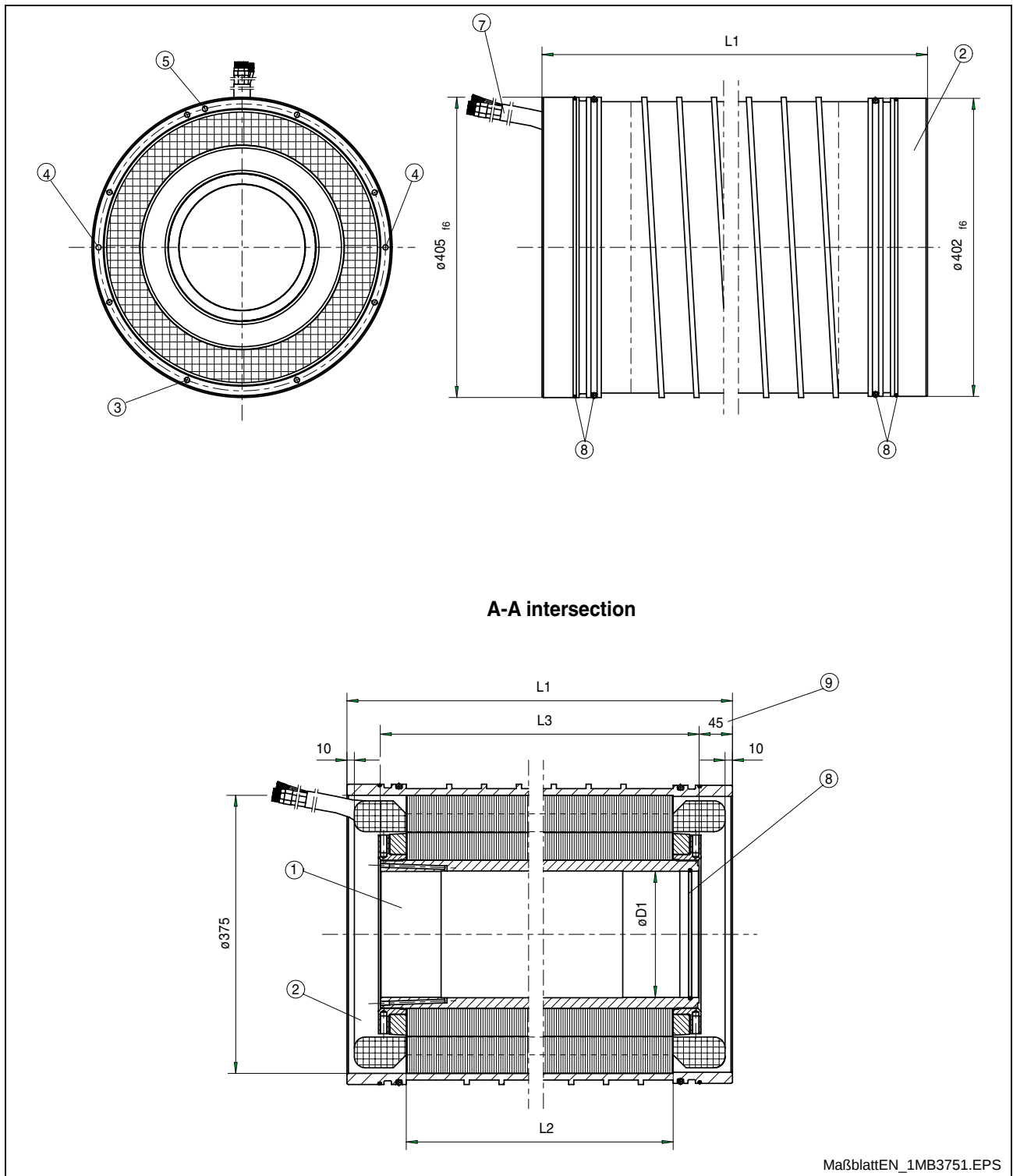
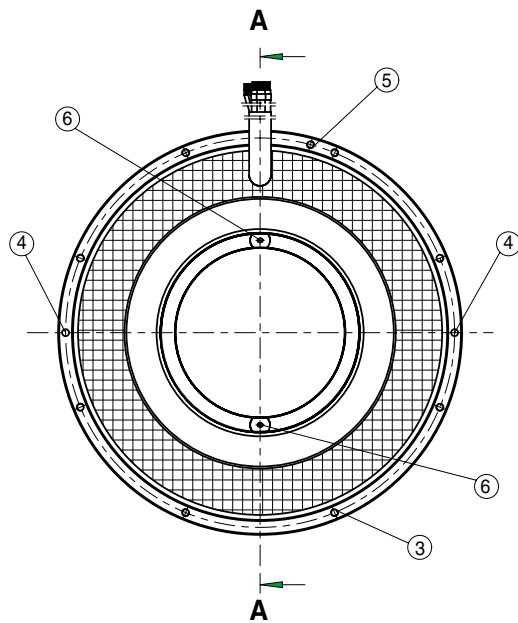


Fig. 5-49: Dimensions sheet 1MB375 (1/2)



- ① Rotor 1MR 375...
- ② Stator 1MS 375...
- ③ 8x M8 thread for axial mounting on the spindle housing
- ④ $\varnothing 7$ drill hole for cylindrical pin to secure against movements with respect to spindle housing
- ⑤ M8 thread for mounting the ground terminal lead
- ⑥ Pressure oil connection step interference fit
- ⑦ Motor winding 1500 mm long
- ⑧ O-ring made of Viton
- ⑨ Positional dimension of rotor to stator

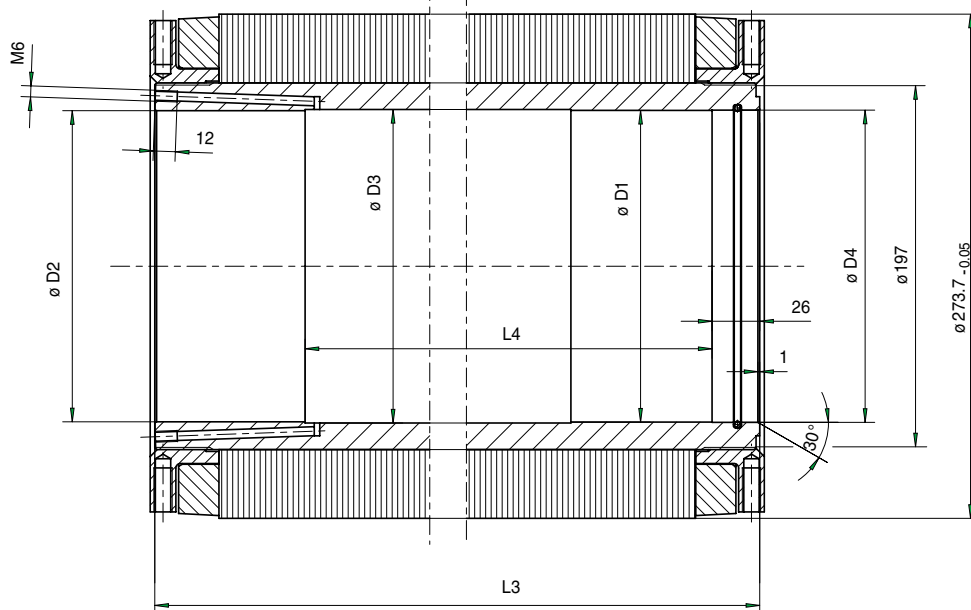
Dim. Type	$\varnothing D 1^{H6}$	L 1	L 2	L 3
1 MB 375 B	170	520	360	430
1 MB 375 D		620	460	530

MaßblattEN_1MB3752.EPS

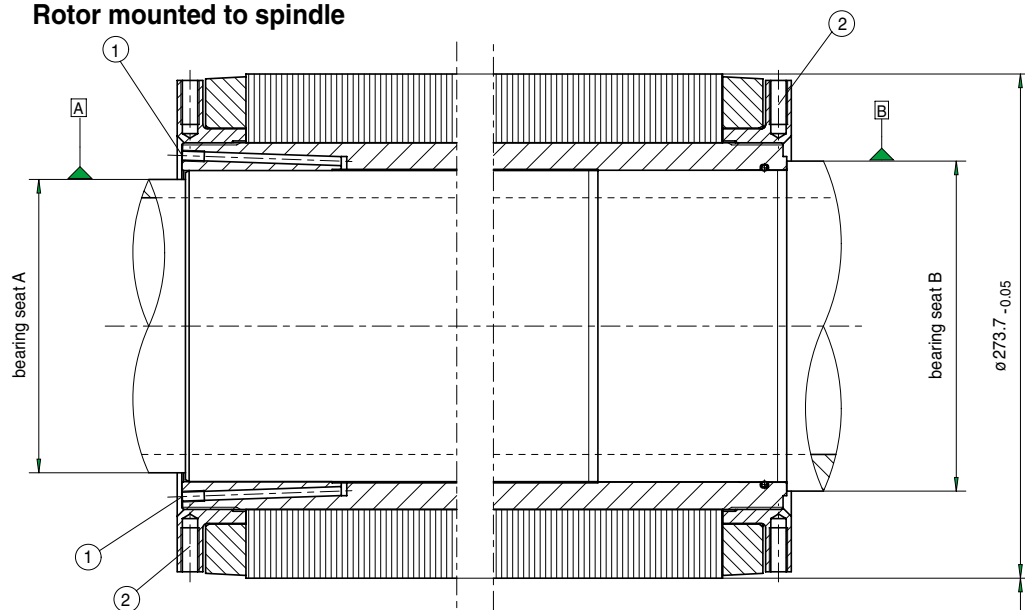
Fig. 5-50: Dimensions sheet 1MB375 (2/2)

Rotor - 1MR375

Rotor 1 MR 375... (condition at delivery)



Rotor mounted to spindle



- ① Pressure oil connection
Sealed with threaded pins as per DIN 913 after rotor is mounted
Threaded pins secured by bonding with LOCTITE 620

- ② Balancing ring with M10 thread
Threaded pins per DIN 913 for equilibrium when balancing
Threaded pins secured by bonding with LOCTITE 620

Threaded pins for ① ②
are part of general delivery.

MaßblattEN_1MR3751.EPS

Fig. 5-51: Dimensions sheet Rotor 1MR375 (1/2)

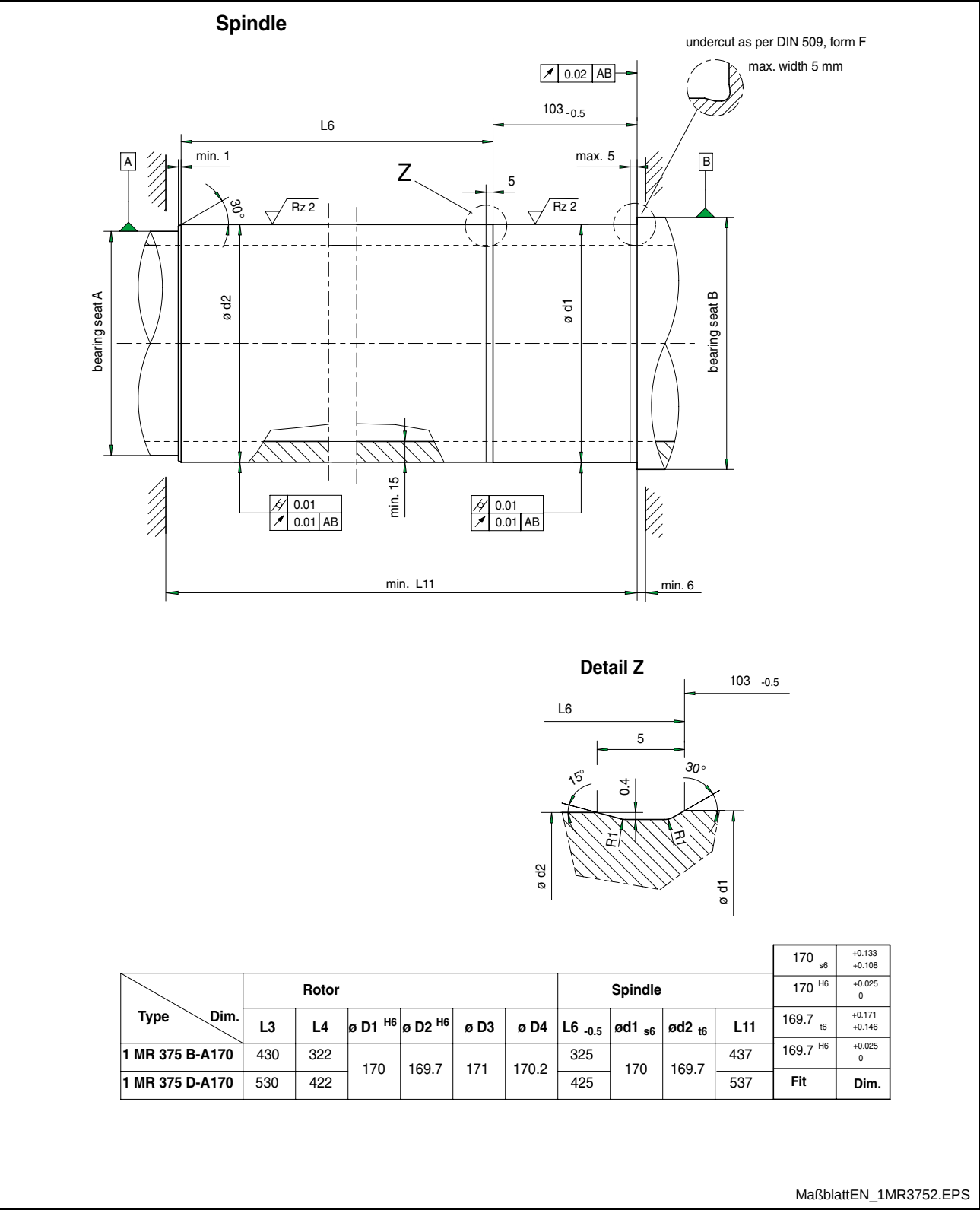
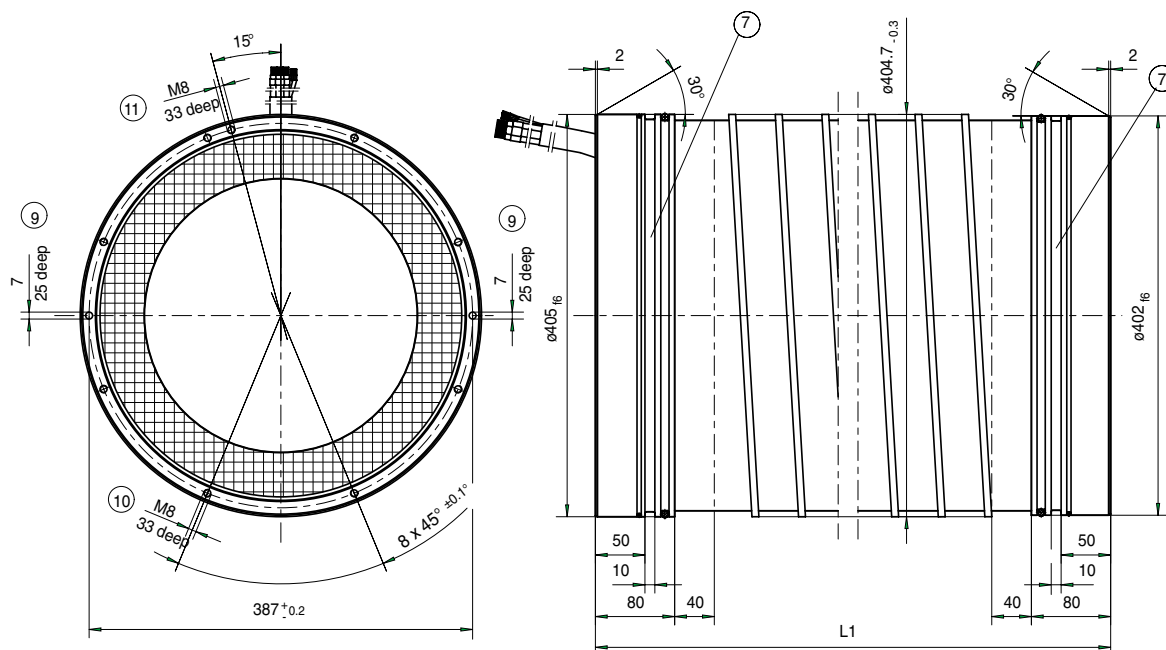


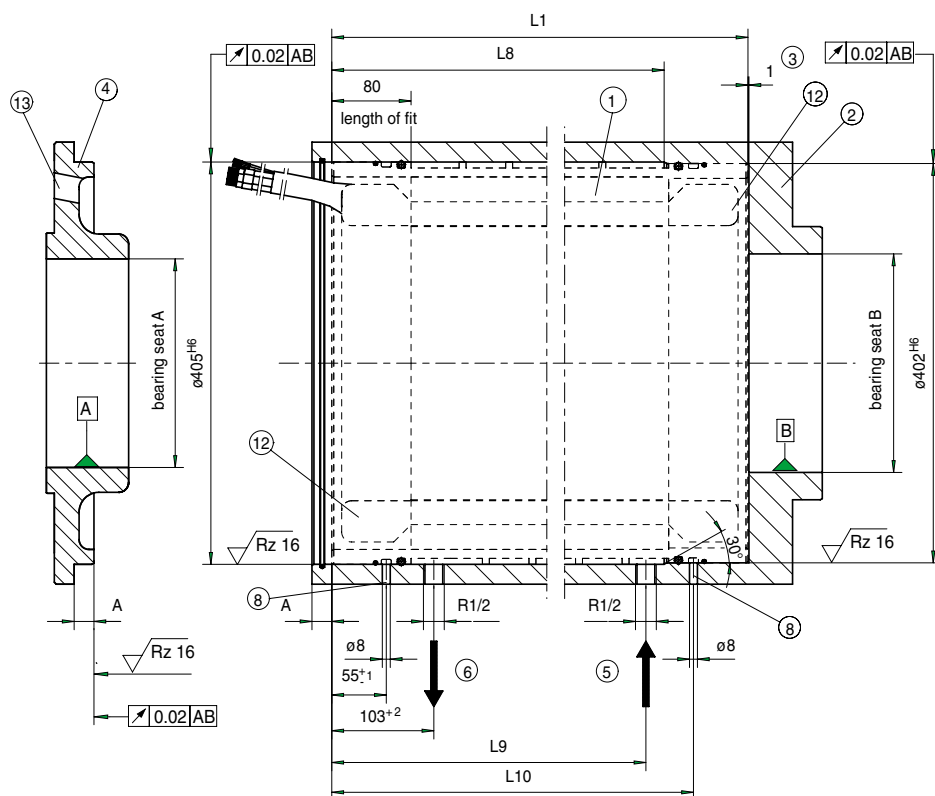
Fig. 5-52: Dimensions sheet Rotor 1MR375 (2/2)

Stator 1MS375



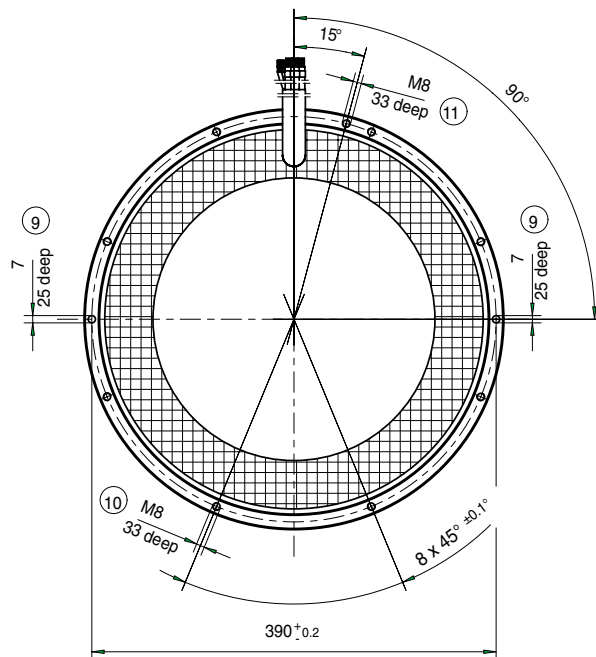
Mounting drill hole:

with axial mounting of the stator to end shield



MaßblattEN_1MS3751.EPS

Fig. 5-53: Dimensions sheet 1MS375 (1/2)

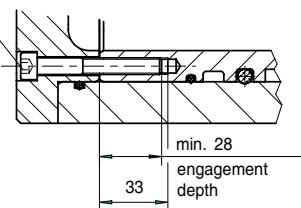


- ① Stator 1 MS 375...
- ② Spindle housing
- ③ Minimum clearance for expansion
- ④ End shield
- ⑤ Coolant feed thread as per DIN 2999 anywhere on circumference
- ⑥ Coolant drain thread as per DIN 2999 anywhere on circumference
- ⑦ Leakage groove
- ⑧ Leakage drill hole
- ⑨ ⑩ ⑪ on either stator end
- ⑫ End winding minimum clearance to housing 5 mm
- ⑬ Cable leadthrough with rounded edges

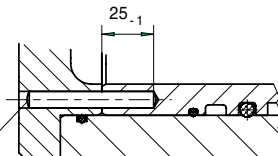
Type	Dim.	L1	L8 +1	L9 -2	L10 ± 1	motor winding	
						øD	bend radius
1 MS 375 B-6B	520	436	417	465		30	150
1 MS 375 D-6B	620	536	517	565			
1 MS 375 D-6D						27	110

⑩ Axial mounting to end shield

Allen screw
DIN 912 M8
strength class 12.9
tensile strength min. 1200 N/mm²
tightening torque 25 ÷ 30 Nm
secured with Loctite 243

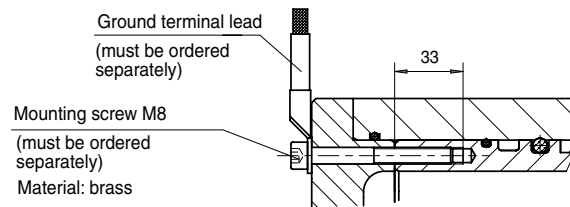


⑨ Secure against movements on end shield



Cylindrical pin DIN 6325 ø8 m6
Tensile strength of material min. 600 N/mm²
hardened, hardness 60 ± 2 HRC

⑪ Mounting ground terminal lead



MaßblattEN_1MS3752.EPS

Fig. 5-54: Dimensions sheet 1MS375 (2/2)

6 Type Code

Definitions

The type code describes the motor variants that are supplied; it is the basis for selecting and ordering products from BOSCH REXROTH. This applies to both new products as well as spare parts and repairs.

1MB motors consist of the components "stator" and "rotor". The type code is divided into "type code for stator 1MS...." and "type code for rotor 1MR....".

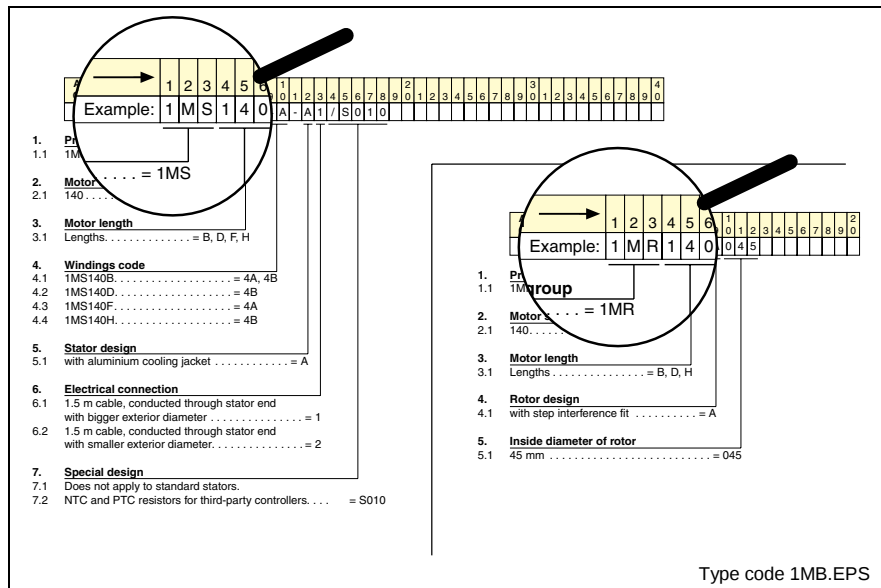


Fig. 6-1: Example of a 1MB type code

The following descriptions provide an overview of the individual positions ("short text column") of the type code and their meaning.

Note: When selecting a product, also consider the specifications in Chapter 4 "Technical Data" and Chapter 9 "Notes Regarding Application".

Type Code for Stator 1MS

1. Product

Short text columns **1 2 3**

1MS is the name of the stator of a 1MB motor.

2. Motor Frame Size

Short text columns **4 5 6**

The frame size of the motor is determined by the mechanical dimensions of the stator; it represents various performance variables.

Available sizes: 1MB**140/160/200/240/241/242/270/310/375**.

3. Motor Frame Length

Short text column **7**

Within a series, the graduation of increasing motor frame length is indicated by ID letters in alphabetic order. The higher the motor frame length, the higher the torque.

Frame lengths are, for example, **A, B, C** and **E**.

4. Winding Code

Short text columns **9 10**

Winding codes "**4A**", "**4B**", etc. are used to differentiate winding variants; they indicate the rated speed.

An intermediate circuit voltage of 540 V_{DC} is used as a fixed reference value.

A drive combination is selected based on the corresponding selection data and operating characteristics.

5. Stator Design

Short text column **12**

Indicates the aluminum cooling jacket. As a rule, 1MB motor are equipped with a stator cooling jacket for operation with **liquid cooling**.

6. Electrical Connection

Short text column **13**

The electrical connection is provided by an approx. 1.5 m long loom of cables. All wires have been equipped with wire end sleeves at the factory.

Depending on the installation situation in the machine, the cables on the stator side can be brought out with a large or a small diameter. For further information, see the "Connection Techniques" section.

7. Special Designs

Short text columns **15 16 17 18**

1MS stators with S010 are equipped with special NTC resistors, PTC resistors and bimetals for monitoring the temperature. This model is suitable for various third-party drives.

Type Code for Rotor 1MR

1. Product group

Short text columns 1 2 3

1MR is the name of the rotor of a 1MB motor.

2. Motor Frame Size

Short text columns 4 5 6

The frame size of the motor is determined by the mechanical dimensions of the stator; it represents various performance variables.

3. Motor Frame Length

Short text column 7

Within a series, the graduation of increasing motor frame length is indicated by ID letters in alphabetic order.

Frame lengths are, for example, **A**, **B**, **C** and **E**.

4. Rotor Design

Short text column 9

A indicates a multiple die press group with a completely processed outer rotor diameter.

C indicates a multiple die press group with an outer rotor diameter with allowance.

5. Inner Rotor Diameter

Short text columns 10 11 12

Indicates the inner diameter of the rotors in millimeters (mm).

6.1 Type Code for Frame Size 140

Stator 1MS140

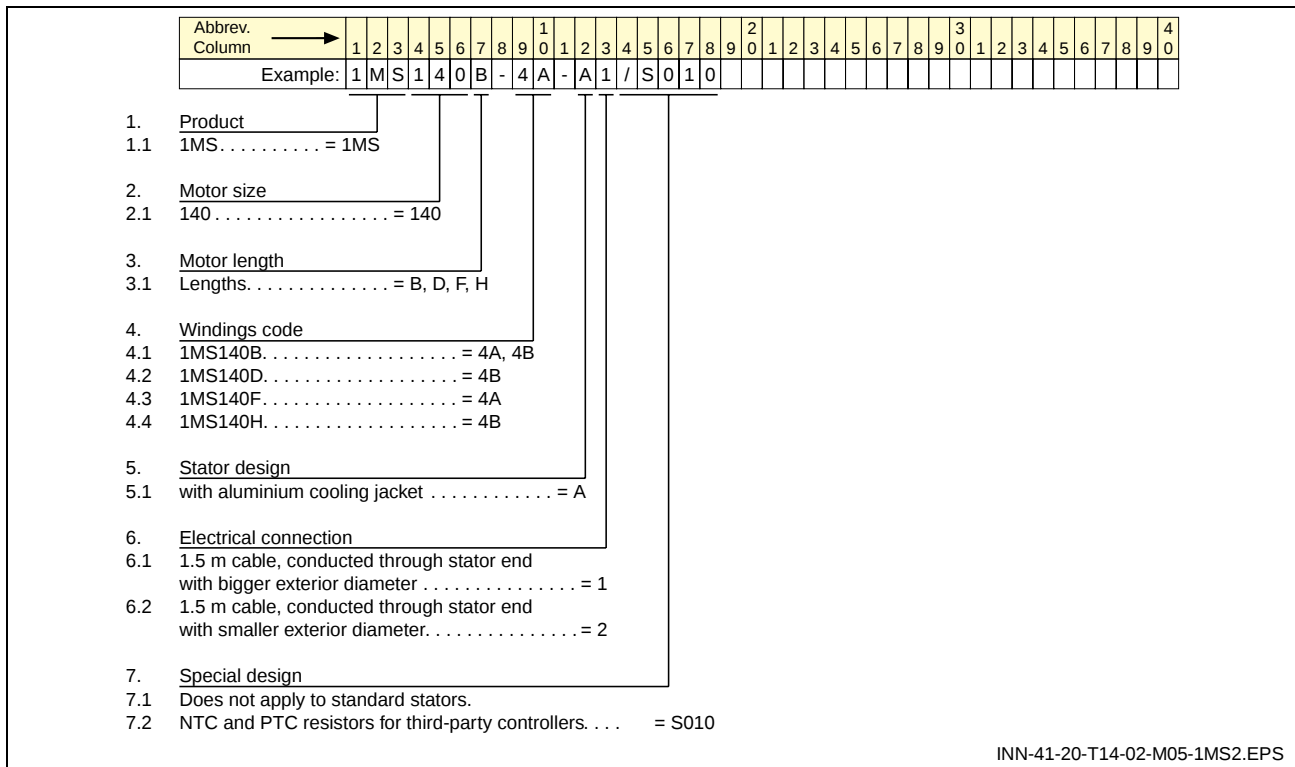


Fig. 6-2: Type code for stator 1MS140

Rotor 1MR140

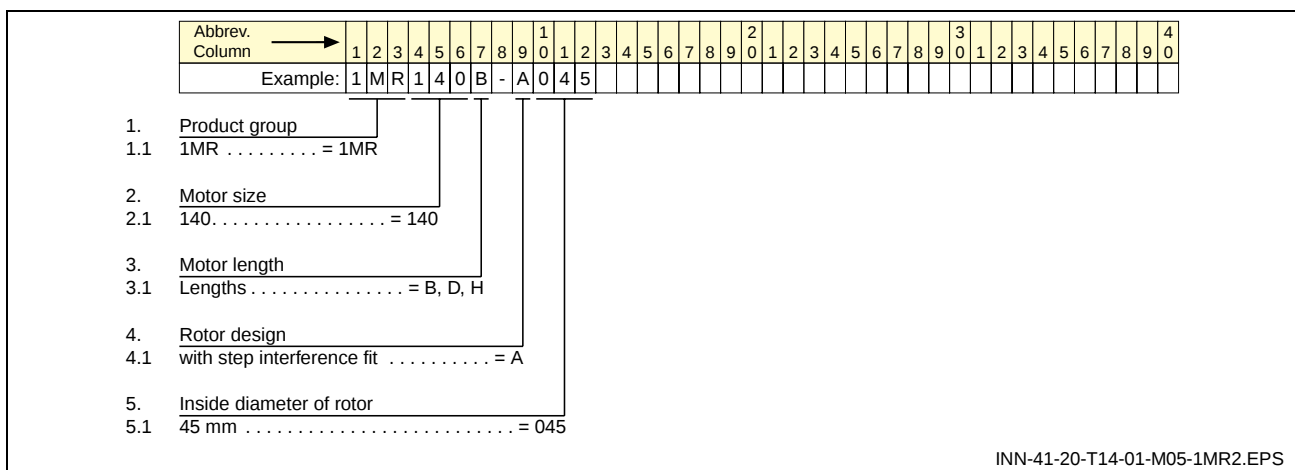


Fig. 6-3: Type code for rotor 1MR140

Stator 1MS160

Fig. 6-4: Type code for stator 1MS160

Rotor 1MR160

Fig. 6-5: Type code for rotor 1MR160

Stator 1MS200

6.4 Type Code for Frame Size 240

Stator 1MS240

[illegible]

Fig. 6-8: Type code for stator 1MS240

Rotor 1MR240

Abbrev. Column		1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4
Example:	→	1	M	R	2	4	O	H	-	A	0	7	2																						

1. Product group
 1.1 1MR = 1MR
2. Motor size
 2.1 240 = 240
3. Motor length ①
 3.1 Lengths = B, F, H
4. Rotor design
 4.1 with step interference fit = A
5. Inside diameter of rotor ①
 5.1 72 mm = 072
 5.2 87 mm = 087

Note:
 ① Motor length "B" is only available with inside diameter of rotor "072"
 Motor length "F" is only available with inside diameter of rotor "087"

INN-41-20-T24-01-M03-1MR2.EPS

Fig. 6-9: Type code for rotor 1MR240

6.5 Type Code for Frame Size 241

Stator 1MS241

Abbrev. Column	1	2	3	4	5	6	7	8	9	1	0	1	2	3	4	5	6	7	8	9	2	0	1	2	3	4	5	6	7	8	9	3	0	1	2	3	4	5	6	7	8	9	4	0		
Example:	1	M	S	2	4	1	H	-	6	D	-	A	1	/	S	0	1	0																												

1. Product

1.1 1MS..... = 1MS

2. Motor size

2.1 241..... = 241

3. Motor length

3.1 Lengths..... = D, H

4. Windings code

4.1 1MS241D..... = 6A, 6C

4.2 1MS241H..... = 6C, 6D, 6G

5. Stator design

5.1 with aluminum cooling jacket = A

6. Electrical connection

6.1 1.5 m cable, conducted through stator end with bigger exterior diameter. = 1

6.2 1.5 m cable, conducted through stator end with smaller exterior diameter. = 2

7. Special design

7.1 Does not apply to standard stators.

7.2 NTC and PTC resistors for third-party controllers. ... = S010

INN-41-20-T24-12-M05-1MS2.EPS

Fig. 6-10: Type code for stator 1MS241

Rotor 1MR241

Abbrev.	Column	1	2	3	4	5	6	7	8	9	1	0	1	2	3	4	5	6	7	8	9	2	0	1	2	3	4	5	6	7	8	9	3	0	1	2	3	4	5	6	7	8	9	4	0			
Example:		1	M	R	2	4	1	H	-	A	1	1	1																																			

1. Product

1.1 1MR = 1MR

2. Motor size

2.1 241..... = 241

3. Motor length

3.1 Lengths..... = D, H

4. Rotor design

4.1 with step interference fit = A

5. Inside diameter of rotor

5.1 66 mm = 066

5.2 98 mm = 098

5.3 111 mm = 111

INN-41-20-T24-11-M03-1MR2.EPS

Fig. 6-11: Type code for rotor 1MR241

6.6 Type Code for Frame Size 242

Stator 1MS242

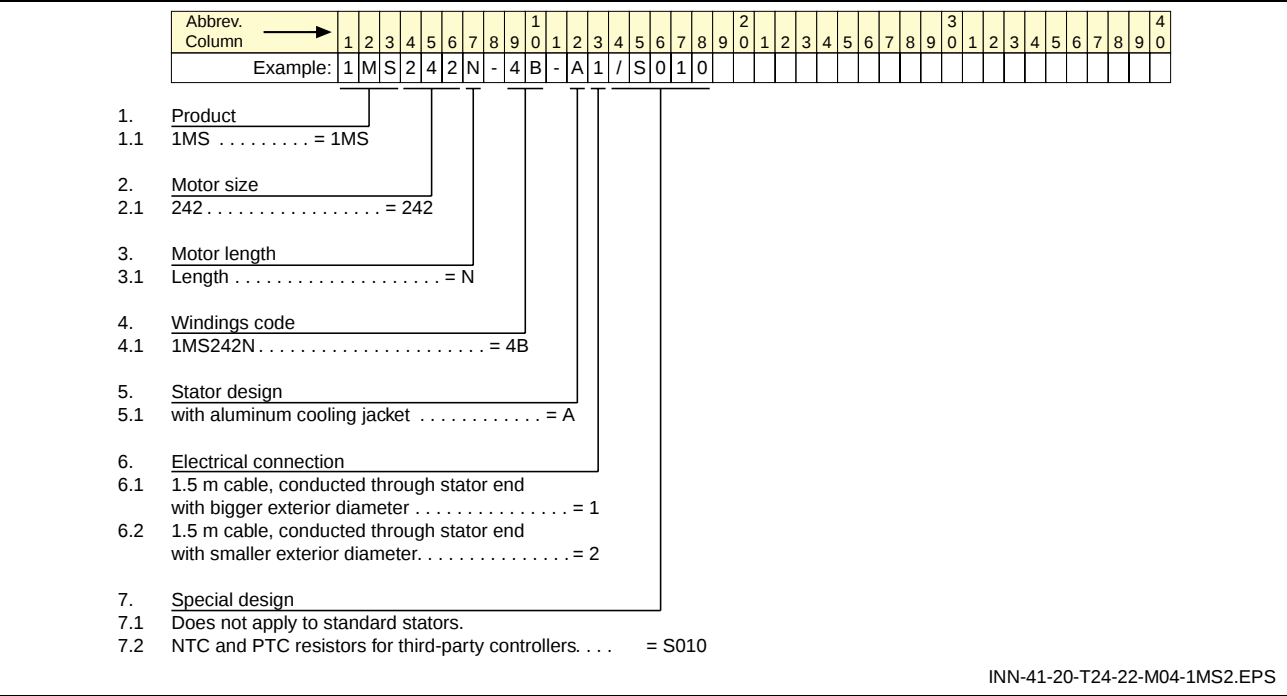


Fig. 6-12: Type code for stator 1MS242

Rotor 1MR242

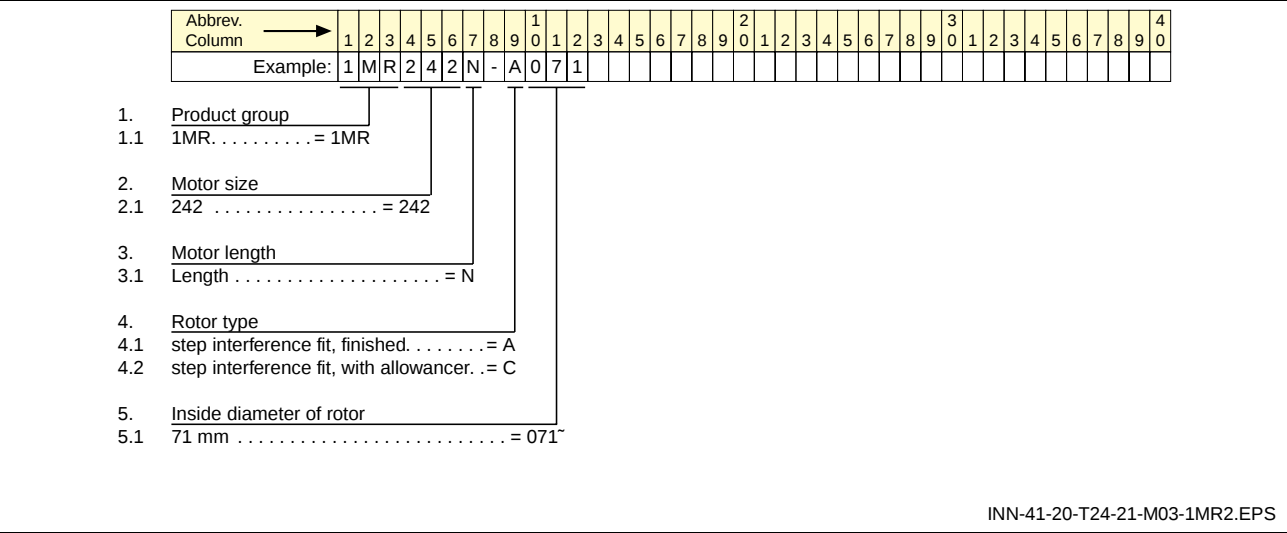


Fig. 6-13: Type code for rotor 1MR242

6.7 Type Code for Frame Size 270

Stator 1MS270

Abbrev. Column	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	2	0	1	2	3	4	5	6	7	8	9	3	0	1	2	3	4	5	6	7	8	9	4	0		
Example:	1	M	S	2	7	0	C	-	4	B	-	A	1	/	S	0	1	0																										

1. Product

1.1 1MS = 1MS

2. Motor size

2.1 270..... = 270

3. Motor length

3.1 Length = C

4. Windings code

4.1 1MS270C..... = 4B

5. Stator design

5.1 with aluminum cooling jacket = A

6. Electrical connection

6.1 1.5 m cable, conducted through stator end
with bigger exterior diameter = 1

6.2 1.5 m cable, conducted through stator end
with smaller exterior diameter. = 2

7. Special design

7.1 Does not apply to standard stators.

7.2 NTC and PTC resistors for third-party controllers. ... = S010

INN-41-20-T27-02-M03-1MS2.EPS

INN-41-20-T27-02-M03-1MS2.EPS

Fig. 6-14: Type code for stator 1MS270

Rotor 1MR270

Abbrev. Column	1	2	3	4	5	6	7	8	9	1	0	1	2	3	4	5	6	7	8	9	2	0	1	2	3	4	5	6	7	8	9	3	0	1	2	3	4	5	6	7	8	9	4	0	
Example:	1	M	R	2	7	0	C	-	A	1	2	0																																	

1. Product group

1.1 1MR = 1MR

2. Motor size

2.1 270 = 270

3. Motor length

3.1 Length = C

4. Rotor type

4.1 with step interference fit = A

5. Inside diameter of rotor

5.1 90 mm = 090

5.2 120 mm = 120

INN-41-20-T27-01-M02-1MR2.EPS

INN-41-20-T27-01-M02-1MR2.EPS

Fig. 6-15: Type code for rotor 1MR270

6.8 Type Code for Frame Size 310

Stator 1MS310

Abbrev. Column	1	2	3	4	5	6	7	8	9	1	0	1	2	3	4	5	6	7	8	9	2	0	1	2	3	4	5	6	7	8	9	3	0	1	2	3	4	5	6	7	8	9	4	0		
Example:	1	M	S	3	1	0	B	-	6	B	-	A	2	/	S	0	1	0																												

1. Product

1.1 1MS..... = 1MS

2. Motor size

2.1 310..... = 310

3. Motor length

3.1 Lengths = B, D, F

4. Windings code

4.1 1MS310B. = 6B, 6D, 6E

4.2 1MS310D. = 6B

4.3 1MS310F. = 6A, 6B

5. Stator design

5.1 with aluminum cooling jacket = A

6. Electrical connection

6.1 1.5 m cable, conducted through stator end with bigger exterior diameter = 1

6.2 1.5 m cable, conducted through stator end with smaller exterior diameter. = 2

7. Special design

7.1 Does not apply to standard stators.

7.2 NTC and PTC resistors for third-party controllers. ... = S010

INN-41-20-T31-02-M03-1MS2.EPS

Fig. 6-16: Type code for stator 1MS310

Rotor 1MR310

Abbrev.	Column	1	2	3	4	5	6	7	8	9	1	0	1	2	3	4	5	6	7	8	9	2	0	1	2	3	4	5	6	7	8	9	3	0	1	2	3	4	5	6	7	8	9	4	0
Example:		1	M	R	3	1	0	D	-	A	0	9	4																																

1. Product group

1.1 1MR = 1MR

2. Motor size

2.1 310 = 310

3. Motor length ①

3.1 Lengths..... = B, D, F

4. Rotor design

4.1 with step interference fit = A

5. Inside diameter of rotor ①

5.1 94 mm = 094

5.2 108 mm = 108

5.3 112 mm = 112

5.4 118 mm = 118

5.5 120 mm = 120

5.6 125 mm = 125

Note:

① Motor length "B" is not available with inside diameter of rotor "118" and "125"
 Motor length "D" is not available with inside diameter of rotor "118"
 Motor length "F" is not available with inside diameter of rotor "120"

INN-41-20-T31-01-M03-1MR2.EPS

Fig. 6-17: Type code for rotor 1MR310

6.9 Type Code for Frame Size 375

Stator 1MS375

Abbrev.	Column	1	2	3	4	5	6	7	8	9	1	0	1	2	3	4	5	6	7	8	9	2	0	1	2	3	4	5	6	7	8	9	3	0	1	2	3	4	5	6	7	8	9	4	0		
Example:		1	M	S	3	7	5	D	-	6	D	-	A	1	/	S	0	1	0																												

1. Product

1.1 1MS = 1MS

2. Motor size

2.1 375..... = 375

3. Motor length

3.1 Lengths = B, D

4. Windings code

4.1 1MS375B..... = 6B

4.2 1MS375D..... = 6B, 6D

5. Stator design

5.1 with aluminum cooling jacket = A

6. Electrical connection

6.1 1.5 m cable, conducted through stator end with bigger exterior diameter. = 1

6.2 1.5 m cable, conducted through stator end with smaller exterior diameter. = 2

7. Special design

7.1 Does not apply to standard stators.

7.2 NTC and PTC resistors for third-party controllers. ... = S010

INN-41-20-T37-52-M04-1MS2.EPS

INN-41-20-T37-52-M04-1MS2.EPS

Fig. 6-18: Type code for stator 1MS375

Rotor 1MR375

Abbrev.	Column	1	2	3	4	5	6	7	8	9	1	0	1	2	3	4	5	6	7	8	9	2	0	1	2	3	4	5	6	7	8	9	3	0	1	2	3	4	5	6	7	8	9	4	0
Example:		1	M	R	3	7	5	B	-	A	1	7	0																																

1. Product group

1.1 1MR..... = 1MR

2. Motor size

2.1 375..... = 375

3. Motor length ①

3.1 Lengths..... = B, D

4. Rotor design

4.1 with step interference fit..... = A

4.2 with shrunk fit disc..... = S

5. Inside diameter of rotor

5.1 125 mm..... = 125 ②

5.2 170 mm..... = 170

Note:

① Motor length "B" is only available with rotor design "A" and inside diameter of rotor "170"

② Inside diameter of rotor "125" is only available with motor length "D" and rotor design "S"

INN-41-20-T37-51-M04-1MR2.EPS

INN-41-20-T37-51-M04-1MR2.EPS

Fig. 6-19: Type code for rotor 1MR375

7 Accessories

Bosch Rexroth currently does not offer any accessories for 1MB assembly kit spindle motors.

8 Connection System

Electrical Connection

The following wiring diagram is schematic. It is the checklist for all required electrical connections for operating the motor spindle with a 1MB motor.

The following electrical connections are located on the assembly kit spindle motor:

- power connector with motor NTC resistor connector
- grounding connector
- motor feedback connector

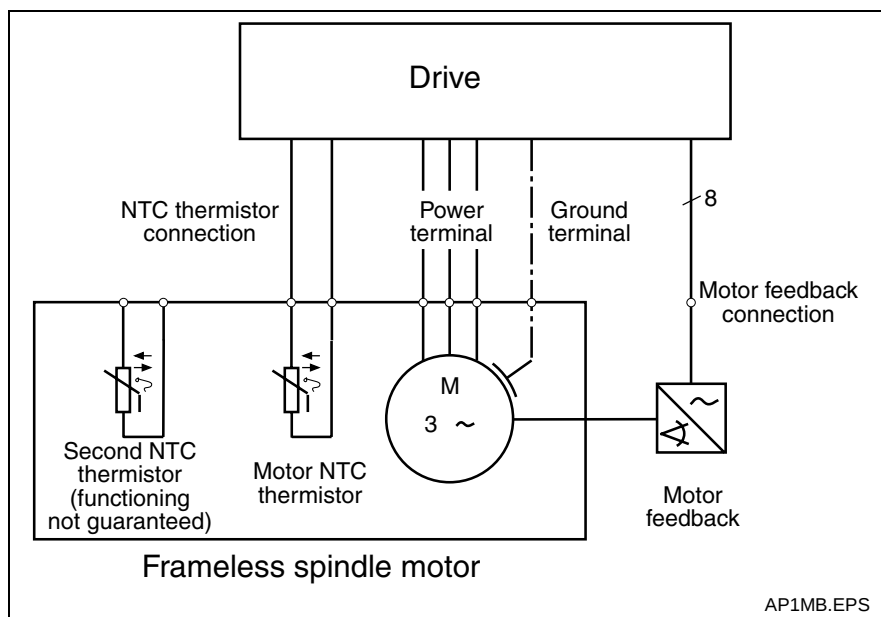


Fig. 8-1: Schematic connection plan for assembly kit spindle motors

8.1 Grounding Connector

The 1MB motor is grounded by the motor power connector on the control device. The grounding connector on the stator of the motor spindle is to be implemented as shown in the dimension sheet. See Chapter "Technical data" section of the corresponding assembly kit spindle motor.

The cross-section of the grounding connector cable corresponds to the minimum wire cross-section (provided in Chapter 4 "Technical data") of the associated 1MB motor.

8.2 Power Connector

The stator is equipped with an approx. 1.5 m long loom of cables. It is enveloped by a protective hose and consists of three power wires – six in the case of motors whose winding can be switched – and two conductor pairs for the NTC resistors located in the winding head.

Power wires in the cable loom

The cross-sections of the power wires in the cable loom depend on the rated current of the motor. Cross-sections of 10, 16, 25 and 35 mm² exist. The cross-section of the conductor pairs for the motor NTC resistor connector is 1.5mm².

The cable loom is a connection within the motor. The insulation of the cable loom is therefore designed for higher temperatures than that of the motor power cable (the connection between the motor spindle and the control device). As a result, the information in Chapter 4 “Technical data” concerning the minimum wire cross-section for the motor power cable generally differs from the cross-sections of the power wires of the cable loom.

The power connector of the assembly kit spindle motor can be provided in a

- clipped connection (terminal box) or a
- plug connection (flange socket) design.

Terminal Box

In the case of a clipped connection, the cable loom of the stator is connected to the motor power cable in a terminal box. The terminal box is attached to the spindle housing. It must be provided with a three- or six-pin terminal board for connecting the power and a terminal with four terminal connections for the NTC resistor connector (see Fig. 8-2). The standards listed in Fig. 8-3 must be heeded to implement the clipped connection according to regulations.

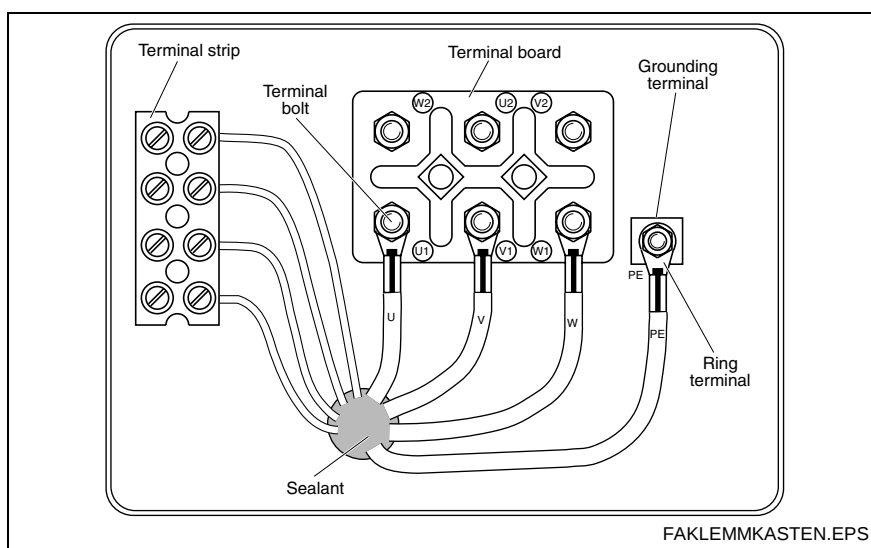


Fig. 8-2: Terminal box (plan view, open)

	Standard	Relationship to clipped connection
Terminal board	DIN 46 294	Max. rated voltage: AC, 660 V
Terminal strip	DIN VDE 0110	Max. rated voltage: AC, 380 V
Terminal studs	DIN 46 200	Determination of the stud diameter
Pinch fork terminals	DIN 46 237	Power wires of the cable loom
Wire end ferrules	DIN 46 228, part 3	NTC resistor wires of the cable loom
Protection type	DIN VDE 0530, part 5	Minimum protection type IP54
Terminal marking	EN 60 445	

Fig. 8-3: Standards for clipped connections

The terminal box must be manufactured with at least protection type IP54 according to DIN VDE 0530, part 5. Seals between the spindle housing and the terminal box must be provided accordingly (Fig. 8-4). The cable duct between the spindle housing and the terminal box is sealed with sealing compound. Screwed connections are not possible!

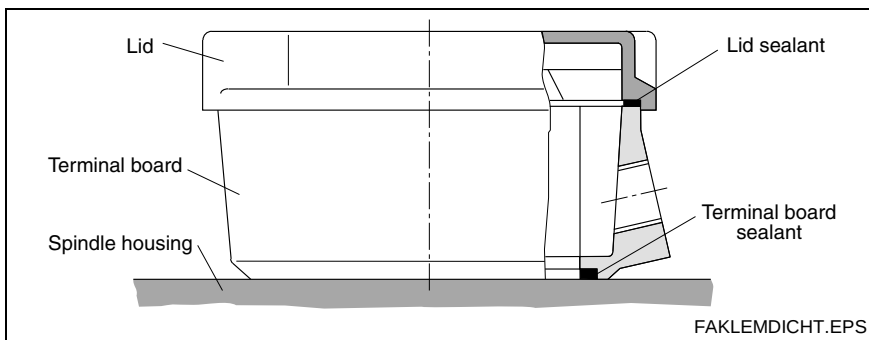


Fig. 8-4: Seals on the terminal box

Rated current up to ...A	Bolt ¹⁾		Hexagon nut ^{1) 2)}	Washer for lug connection ^{1) 2)}
	Thread <i>d</i>	Material		
10	M3.5	CuZn37 F45	DIN 439-AM 3.5-MS	DIN 125-3.7-MS
16	M4		DIN 439-AM 4-MS	DIN 125-4.3-MS
25	M5		DIN 439-AM 5-MS	DIN 125-5.3-MS
63	M6		DIN 439-BM 6-MS	DIN 125-6.4-MS
100	M8		DIN 439-BM 8-MS	DIN 125-8.4-MS
160	M10		DIN 439-M 10-MS	-
250	M12		DIN 439-M 12-MS	-

¹⁾ Materials that are electrically and mechanically at least equivalent are also permitted.
²⁾ Additional nuts and washers for, e.g. fastening may be made of steel.
Pay attention to heating due to eddy currents.

Fig. 8-5: Current ratings of connection bolts according to DIN 46 200

Terminal box suppliers

The components for the connection with a terminal box are not available from Bosch Rexroth. Possible suppliers are:

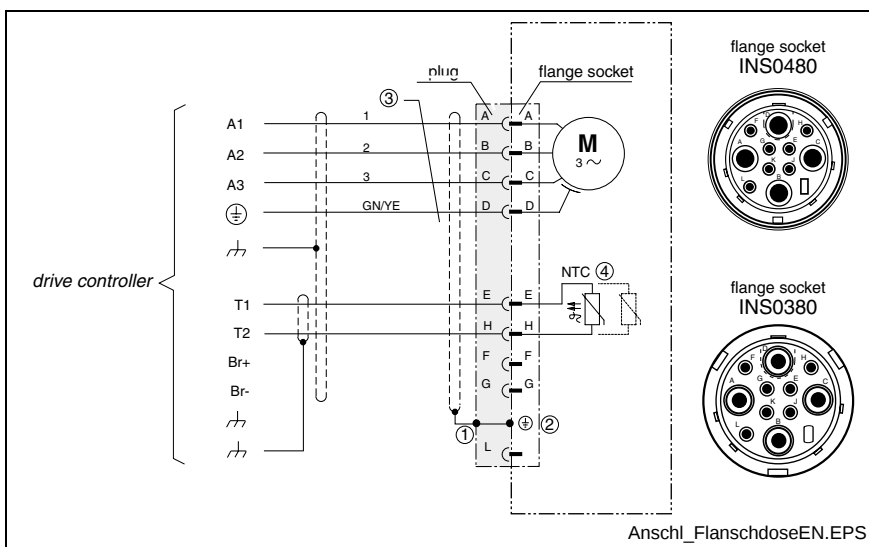
Component	Supplier
Terminal box	KIENLE & SPIESS Stanz- und Druckgießwerk GmbH 74343 Sachsenheim, Germany Tel.: +49 (0) 71 47 29 - 0 Fax: +49 (0) 71 47 29 - 1488 Internet: www.kienle-spiess.de
Terminal board	REKOFA WENZEL GmbH & Co. KG 53474 Bad Neuenahr-Ahrweiler, Germany Tel.: +49 (0) 26 41 / 387 - 0 Fax: +49 (0) 26 41 / 387 - 33 95
Terminal strip	WIELAND ELECTRIC GmbH 96052 Bamberg, Germany Internet: www.wieland-electric.com

Fig. 8-6: Terminal box suppliers

Plug Connection / Flange Socket

In the case of a plug connection, the cable loom of the stator is connected to the motor power cable using a flange socket.

The wires of the power connector and the conductor pairs of the motor NTC resistor are soldered onto the rear side of the flange socket. The flange socket is screwed onto the spindle housing from the outside.



- 1): Shield connection using cable clamp of strain relief
- 2): Electrically conducting connection to motor housing
- 3): For the minimum cross-section of the power cable, see the motor data sheet
- 4): Functioning of a replacement NTC resistor is not guaranteed.

Fig. 8-7: Sample connection: Bosch Rexroth INS380/480 flange socket

The coupling and the plug for connecting 1MB motors have a bayonet connection.

The flange sockets shown in Fig. 8-7, with type designations INS380/INS480, can be obtained from Bosch Rexroth. They are suitable for wire cross-sections up to 35mm² (INS380) and continuous rated currents of 40A (INS480) to 100A (INS380). The clipped connection is to be used for larger wire cross-sections.

Note: The coupling and the plug for connecting 1MB motors are not included in the scope of delivery. Optionally, however, the flange sockets mentioned above can be ordered with correspondingly assembled cables, for example. You can get information on selecting the connection plugs for your specific application from your sales partner.

Note: Cable loom ducts on the motor spindle should be constructed in such a manner that the motor spindle can be disassembled without desoldering the cable loom from the flange socket.

DIAX04/ECODRIVE Drive Control Device Connections

In the following, the connection of the power supply and the temperature monitor to the drive control device is described.

The following overview shows the connection/terminal designations for the power connector and the motor temperature monitor.

Drive control device	Terminal block designation, power connection	Terminal designation, power connection	Terminal block designation, motor temperature monitor	Terminal designation, motor temperature monitor
HDS0x.x DKCxx.x DKR0x.x	X5	A1, A2, A3	X6	1 and 2

Fig. 8-8: Terminal designations of drive control devices

Connection diagram

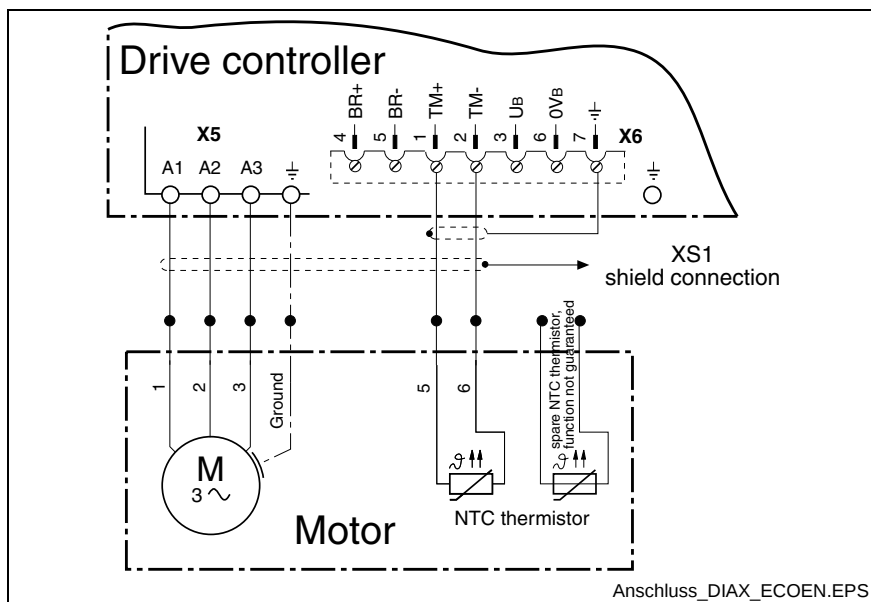


Fig. 8-9: Connections to the drive control device

IndraDrive Drive Control Device Connections

The following overview shows the connection/terminal designations for the power connector and the motor temperature monitor.

Drive control device	Terminal block designation, power connection	Terminal designation, power connection	Terminal block designation, motor temperature monitor	Terminal designation, motor temperature monitor
IndraDrive M IndraDrive C	X5	1, 2, 3	X6	1 and 2

Fig. 8-10: Terminal designations of drive control devices

Connection diagram

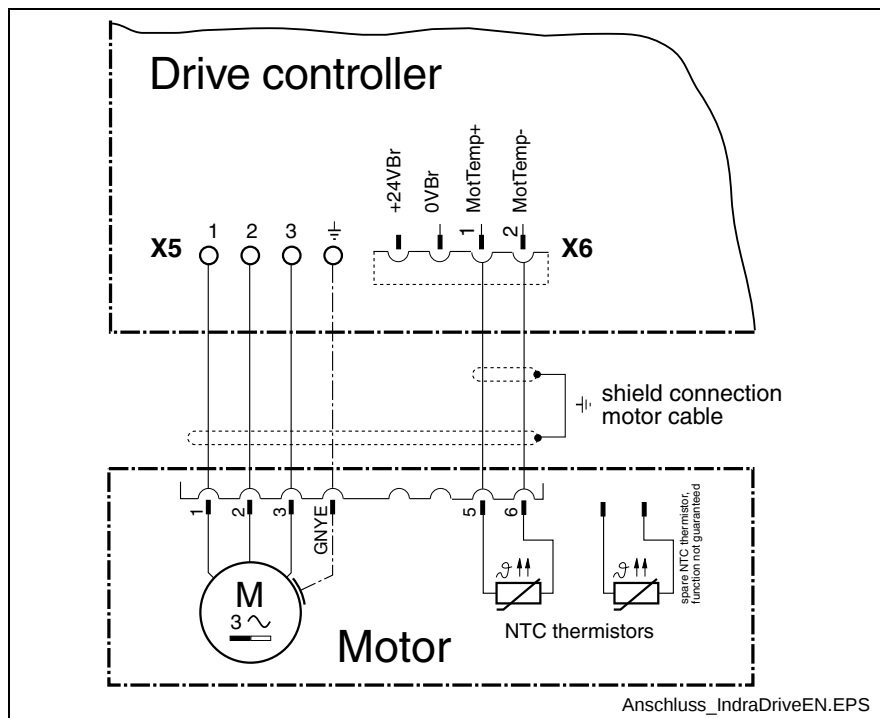


Fig. 8-11: Connections to the drive control device

8.3 Temperature Sensor

In 1MB motors, two temperature sensors (NTC) are permanently installed in the motor winding – only one sensor is connected (see Figs. 8-9 and 8-11). The wires for connecting the sensors are led out with the power connector in the terminal box or the flange socket.

If a sensor fails, the spare sensor can continue to be used.

Note: The polarity within a pair of wires is not relevant for the functioning of the NTC resistor.
The functioning of the replacement NTC resistor cannot be guaranteed.

Motor with terminal box The pair of wires of the spare sensor is already laid out on the terminal block in the terminal box.

Motor with power plug The pair of wires of the spare sensor lies electrically insulated in the flange socket housing. In order to be able to connect the spare sensor, the housing must be opened.

8.4 Encoder Connection

The encoder and the encoder connection components are not in the scope of delivery of the motor. Choose the components according to the requirements of the machine.

You can find further information about encoders in Chapter "Notes Regarding Application".

Note:

The cables for connecting the motor encoder and the device controller must have a compatible plug on the motor side.

8.5 Selecting Ready-to-Use Cables for the Power Supply

Selecting ready-to-use power cables The selection of ready-to-use power cables depends on the power output of the motors and the required connection type (terminal box or flange socket).

Note: Ready-to-use cables for connecting 1MB motors are not included in the scope of delivery. Optionally, however, correspondingly assembled cables can be ordered. You can get information on selecting power cables suitable to your specific application from your sales partner.

8.6 Motor Cooling

1MB motors are delivered as frameless motors, without a motor housing, for mounting in the machine. The selection and sizing of the connection system is to be made by the machine manufacturer.

- ⇒ Note the motor data in this documentation, as well as the general details for **dimensioning** systems in the documentation "Liquid cooling of Rexroth drive components...", Mat. No. R911265836.
- ⇒ Install systems for flow, pressure and temperature control within the cooling circuit.
- ⇒ Note that intake and outflow are only possible in the position shown in the dimension sheet.

The assignment of intake and outflow has no influence on the performance data of the motor. For standardization and easy handling, an arrangement should be maintained once it is set.

Operating Pressure

The maximum coolant supply pressure of **3 bar** applies to all 1MB motors, based on the effective current pressure directly on the coolant connection of the motor.

Please observe that additional threads or branch connections in the cooling circuit can reduce the flow and supply pressure of the coolant.

- ⇒ Select generously dimensioned connection threads and tube cross-sections.

9 Notes Regarding Application

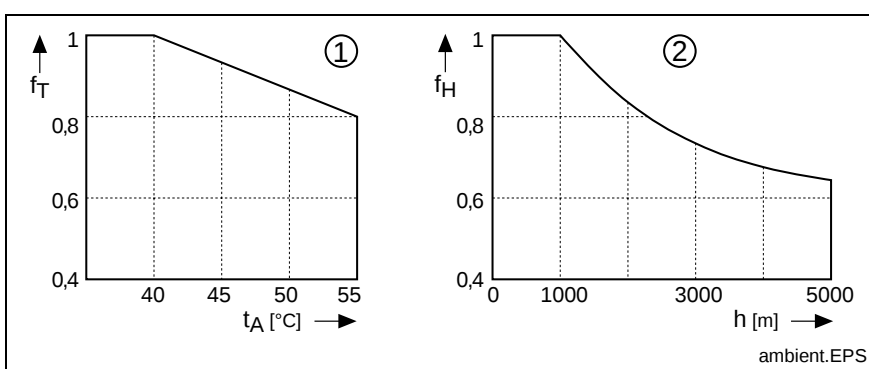
9.1 Conditions for Use

Setup Elevation and Ambient Temperature

The performance data specified for the motors apply in the following conditions:

- ambient temperature between 0°C and +40°C
- setup elevation of 0m to 1,000m above sea level.

If you want to use the drive systems in areas with values beyond these ranges, the performance data are reduced according to the following figure:



- (1): Utilization depending on the ambient temperature
 (2): Utilization depending on the site altitude
 f_T : Temperature utilization factor
 t_A : Ambient temperature in degrees Celsius
 f_H : Height utilization factor
 h : Setup elevation in meters

Fig. 9-1: Utilization factors

If **either** the ambient temperature **or** the setup height exceeds the nominal data:

1. Multiply the motor data provided in the selection data with the calculated utilization factor.
2. Ensure that the reduced torque data are not exceeded by your application.

If **both** the ambient temperature **and** the setup height exceed the nominal data:

1. Multiply the determined utilization factors f_T and f_H by each other.
2. Multiply the value obtained by the motor data specified in the selection data.

Ensure that the reduced motor data are not exceeded by your application.

Note: The information for utilization depending on the site altitude and ambient temperature using the specified liquid coolant do not apply solely to the motor, but to the entire drive system, consisting of the motor, drive controller and mains supply.

9.2 Motor Cooling

The heat of the transformed motor power loss P_V is dissipated by the cooling system. 1MB motors may thus be operated only if the supply of coolant is ensured. The cooling system must be designed by the machine manufacturer in such a way that all requirements for flow, pressure, cleanliness, temperature gradient etc. are maintained in every operating mode.



CAUTION

Impairment or loss of motor, machine or cooling system!

- ⇒ You absolutely must take into account the motor data and the explanations of the cooling system concept in the documentation "Liquid cooling, dimensioning, selection", Mat. No. R911265836.
- ⇒ Heed the manufacturer instructions for the construction and operation of cooling systems.
- ⇒ Do not use any lubricants or cutting lubricants from operating processes.
- ⇒ Avoid pollution of the cooling medium as well as changes of the chemical consistency and of the pH value.

Coolants

All information and technical data refer to water as the coolant. If other coolants are used, these data are no longer valid and must be recalculated.

Cooling with flowing water is not recommended. Hard water can cause deposits and damage the motor and the cooling system.

For corrosion protection and for chemical stabilization, the cooling water must have an additive which is suitable for mixed installations with the materials AlSi5Mg (cooling jacket) and FPM (O-ring)

If aggressive coolants, additives and cooling lubricants are used or if the coolant is polluted, 1MB motors may be damaged irreparably.

- ⇒ Use systems with a closed circuit and a fine filter $\leq 100 \mu\text{m}$.
- ⇒ Avoid pollution of the cooling medium as well as changes of the chemical consistency and of the pH value.
- ⇒ Consider the environmental protection and waste disposal regulations at the place of installation when selecting the coolant.

Bosch Rexroth can give no general statements or investigations regarding the applicability of system-specific coolants or operating conditions.

Note: The performance test for the used coolants and the design of the liquid coolant system are generally the responsibility of the machine manufacturer.

Watery Solutions

Watery solutions ensure a reliable corrosion protection without significant changes of the physical property of the water. The recommended additives contain no harmful materials to water.

Emulsion with Corrosion Protection

Corrosion protection oils for coolant systems contain emulsifiers which ensure a fine distribution of the oil in the water. The oily components of the emulsion protect the metal surfaces of the coolant ducts against corrosion and cavitation. An oil content of 0.5 - 2 volume percent has proved itself.

If the duty of the corrosion protection oil is to function not only as corrosion protection, but also as a coolant pump lubricant, an oil content of 5 volume percent is necessary.

⇒ Note the instructions of the pump manufacturer!

Description	Manufacturer (Germany)
1-3% solutions	
Aquaplus 22	Petrofer, Hildesheim
Varidos 1+1	Schilling Chemie, Freiburg
33% solutions	
Glycoshell	Deutsche Shell Chemie GmbH, Eschborn
Tyfocor L	Tyforop Chemie GmbH, Hamburg
OZO antifreeze	Deutsche Total GmbH, Düsseldorf
Aral radiator antifreeze A	ARAL AG, Bochum
BP antifrost X 2270 A	Deutsche BP AG, Hamburg
Emulsifiable mineral oil concentrate	
Shell Donax CC (WGK: 3)	Shell, Hamburg

Fig. 9-2: Recommended coolant additives

Coolant Temperature

The permissible temperature range of the coolant is 10-40°C. This temperature absolutely must be maintained. At higher temperatures, a strong reduction of the available torque can occur. Lower temperatures can lead to destruction of the motor because of high temperature gradients.

⇒ Install systems for flow, pressure and temperature control within the cooling circuit.

Note: To effectively prevent condensation in the cooling system, the coolant entry temperature must not be below room temperature.

9.3 Notes Regarding the Heat Loss of the 1MB Motors

The dissipated heat of the frameless spindle motor in the motor spindle is removed mainly by the fluid cooling system. The end shields and the rotating spindle also play a role in removing the heat.

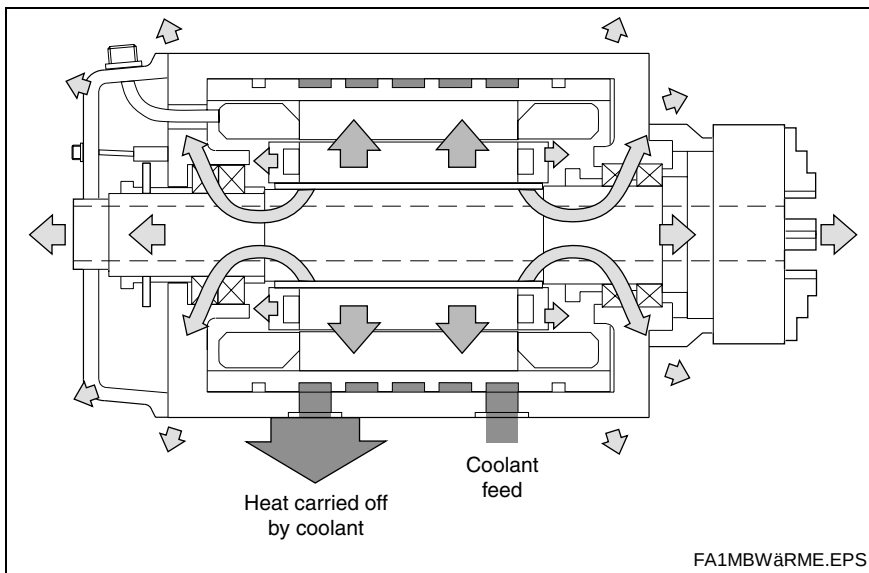


Fig. 9-3: Heat currents in the motor spindle

Heat loss of the stator

The frameless spindle motor is designed in such a way that most of the heat dissipation occurs in the stator. This heat is transferred to the coolant effectively and very quickly via the stator cooling jacket, around which the fluid flows. Furthermore, the coolant provides uniform temperature regulation of the spindle housing.

Information for dimensioning the fluid cooling system is contained in the technical data of the corresponding motor. Instructions for dimensioning and selecting a cooling system are provided in the documentation "Liquid cooling of Indramat drive components" Mat. No. R911265836.

Heat loss of the rotor

About one-third of the power loss of the frameless spindle motor occurs in the rotor. Most of this heat is removed through the air gap on the stator. A small portion of the heat energy is removed via the spindle, the bearing and the end plate. This heat loss depends on the type and volume of the materials through which the heat flows.

The increase in temperature of the bearing due to the heat loss depends on

- the degree of utilization of the motor (heat input) and
- the mechanical construction (heat removal).

The temperature distribution depends on the associated situation and can be determined using a FEM-based thermal transmission calculation (Finite Element Method).

Sample thermal transmission calculation

As an example, a thermal transmission calculation was made for a motor spindle construction with the 1MB310D frameless spindle motor. The

temperature variation was calculated for a rated power output of a spindle with a hole.

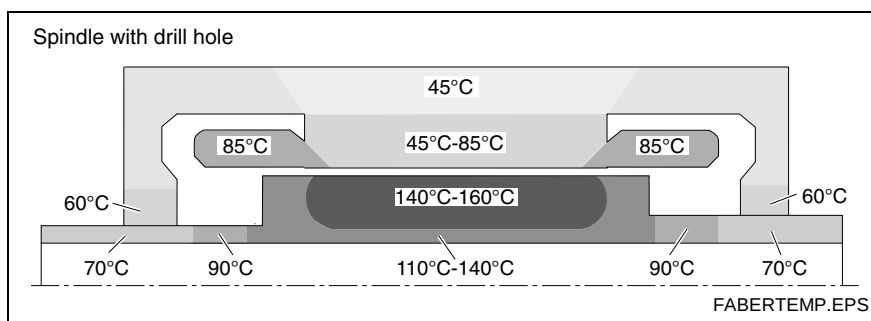


Fig. 9-4: Example of a calculated temperature variation

Note: The temperature variation is different for every spindle construction and for every motor type. The temperature variations shown in Fig. 9-4 should not be generalized. They are to be used only as an approximation for similar constructions.

Due to constructional measures, additional heat can be kept from the bearings. As an example of this, Fig. 9-5 shows fluid-cooled cuffs that provide additional cooling in the immediate vicinity of the rotor and spindle. Depending on the flow-related interconnection, the pressure drop or the flow volume of the motor spindle must be heeded!

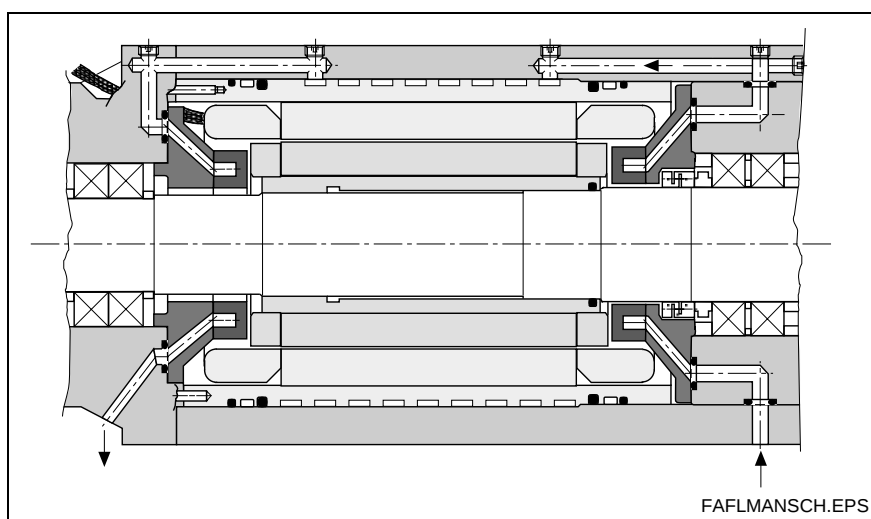


Fig. 9-5: Fluid-cooled cuffs mounted near the rotor

Temperature gradients in the spindle bearing

The bearings are radially pretensioned by the fittings and tolerances for the shaft seat and the housing hole.

Due to the varying thermal expansion, a temperature gradient between the inner and outer rings of the spindle bearing increases this pretension. As a result, friction losses increase and the bearings heat up further. Overheating of the spindle bearing leads to damage to the bearing.

Therefore, ensure that there is a low temperature difference in the spindle bearing when you lay out the motor spindle.

Alternatively, constructional measures can be used to conduct additional heat to the outer ring of the bearing.

For example, cooling rings such as those shown in Fig. 9-6 conduct a portion of the heat generated by the rotor directly to the end plate. As a result, the outer ring of the bearing heats up and the temperature gradient is reduced.

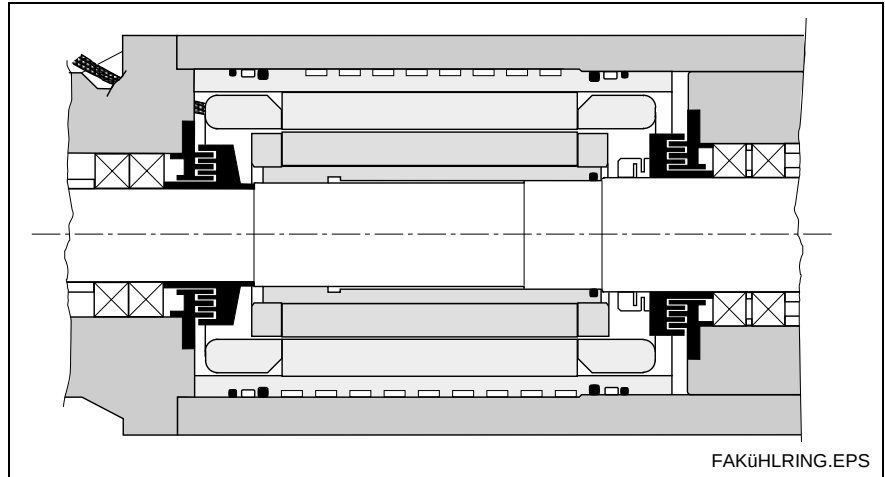


Fig. 9-6: Cooling rings mounted near the rotor

9.4 Protection Class

The type of protection is defined by the identification symbol IP (International Protection) and two code numbers specifying the degree of protection. The first code number describes the protection class against touch and penetration of foreign substances, the second code number describes the protection class against water.

Protection class **IP00** according to IEC 60529:1989 + A1:2000 is valid for the stator and rotor of the 1MB series. The applicability of the 1MB motor for certain conditions must be checked carefully.

Heed the following list (without any guarantee on completeness).

- Difficulties**
- use of the motor in a damp environment or a foggy atmosphere.
 - use of cooling lubricants, aggressive materials or other liquids.
 - cleaning procedures with high pressure, steam or jets of water.

- Possible effects**
- chemical or electrochemical interaction with subsequent corrosion or decomposition of motor parts.
 - damage of the winding insulation and irreparable damage of the motor.

- Possible countermeasures**
- use suitable covers or seals to protect the motor.
 - use only cooling lubricants and other materials that have no aggressive or decomposing effect on the motor parts.
 - do not clean with high pressure, steam or jets of water.

The machine manufacturer is responsible for the testing and execution of suitable measures.

9.5 Compatibility with Foreign Substances

All Rexroth controls and drives are developed and tested according to the state of the art.

However, since it is impossible to follow the continuing further development of every material with which our controls and drives could come into contact (e.g. lubricants on tool machines), reactions with the materials that we use cannot be ruled out in every case.

For this reason, you must execute a compatibility test between new lubricants, cleansers, etc. and our housings and device materials before using these products.

9.6 Motor Feedback

In order to control the spindle speed or to position the spindle, the spindle position must be evaluated by the device controller. Motor feedback is required for this.

The high-resolution Rexroth Indramat main spindle position encoder is used as the motor feedback for frameless spindle motors. It consists of a measuring wheel and a contact-free sensor. The measuring wheel is mounted directly on the spindle and the sensor is attached to the spindle housing.

Three measuring wheel sizes are available for the various frame sizes of the frameless spindle motors.

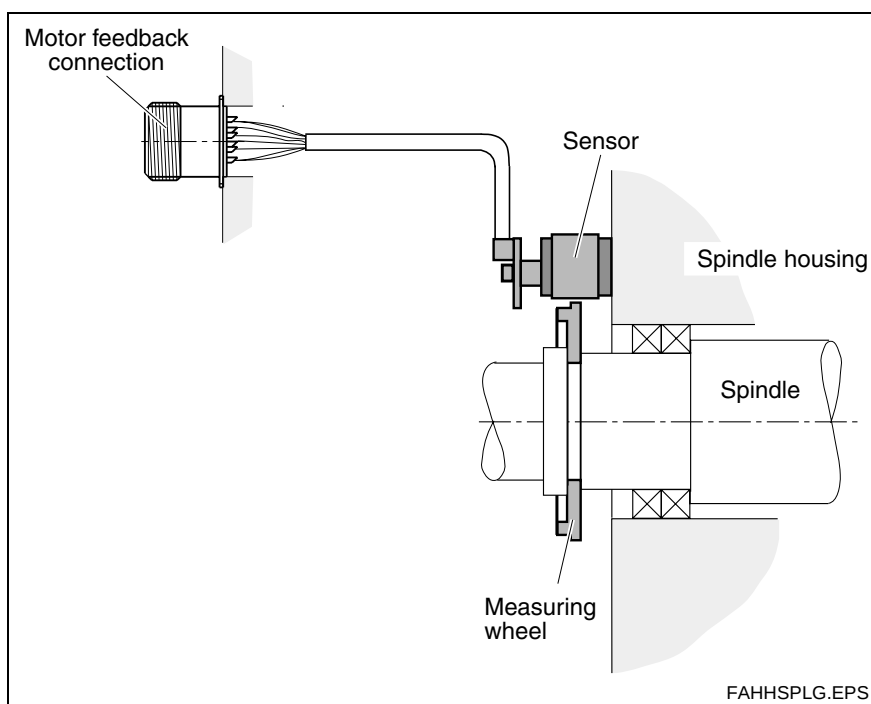


Fig. 9-7: High-resolution main spindle position encoder

The portion of the main spindle position encoder that is on the motor spindle must be executed in protection class IP54 according to DIN VDE 0530 Part 5.

For further information about the constructional installation of the position encoder in the motor spindle, see the documentation "High-resolution main spindle position encoder", Doc. No. 209-0042-4119, Mat. No. R911260005.

9.7 Accuracy

The accuracy of a motor spindle depends on its mechanical design and the control technology.

Mechanical design The degree of motor spindle precision which can be achieved is affected by the rigidity of the system's housing/bearing/spindle as well as by its operating precision. The operating precision in both the axial and radial directions depends on the layout of the bearing and its accuracy. These demands are satisfied by an appropriate spindle construction.

Control technique The operating precision of the spindle depends on the control quality of the motor / motor feedback / control device drive systems. The rotational position accuracy of the spindle is determined by the resolution of the spindle position by the control device and the absolute position accuracy of the motor feedback:

- The control device detects the spindle position signal from the high-resolution main spindle position encoder with a precision of up to $1/4,000,000^{\text{th}}$ of a rotation.
- The size of the measuring wheel and the accuracy with which it is mounted determine the precision with which the absolute position can be measured.

For further information see the documentation "High-resolution main spindle position encoder", Doc. No. 209-0042-4119, Mat. No. R911260005.

The position accuracy of the spindle, which is so important to C-axis operation, depends on the resolution of the spindle position and the type and resolution of the speed command value. The speed command value of the NC control can be transmitted to the control device in three different ways:

- analog, max. +/- 10V
- digital, 16-bit parallel
- Sercos interface

A performance feature of these three modes of speed command value entry is a very broad speed range – from a minimum speed (0.0005 rpm) to a maximum speed.

Analog, max. +/- 10V

This interface is equipped with two differential inputs. The resolution can be set using corresponding parameters.

Digital, 16-bit parallel

This ensures high command value accuracy at small command values and long transmission paths.

SERCOS interface

The SERCOS fiber optical interface offers the most powerful mode of command value entry. In addition to the command value (position, speed or torque command value), it also transmits the actual values and the drive diagnostics.

For further information, see the documentation "AC main spindle drives with controlled asynchronous motor or 1MB frameless spindle motor", Doc. No. 209-0042-4119, Mat. No. R911268109.

10 Handling, Transport and Storage

When selecting transport and lifting equipment, take note of the various weights and frame sizes of the individual models.

Great care must also be used in the models that can be transported by hand; the transport and storage regulations must be observed accordingly.

10.1 Rotor

Lifting and transporting

During transportation, ensure that the fitting on the inside of the rotor is not damaged. Damage in this area may make it impossible to remove the rotor from the spindle.



Damage caused by lifting equipment!

⇒ The rotor must be lifted and transported only with sling hoisting belts made of plastic or with a special hook that is sheathed in plastic.

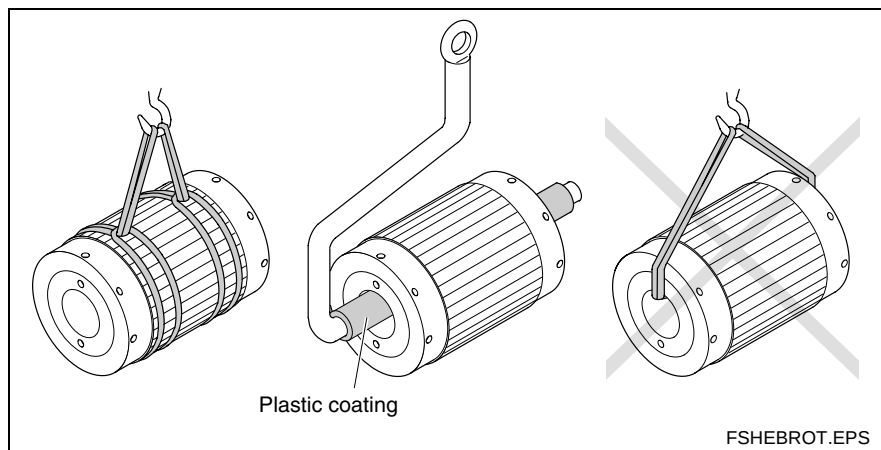


Fig. 10-1: Lifting the rotor with a plastic loop lifting belt or a special hook.

Storage

The rotor is delivered in a horizontal position, packed in Styrofoam half-shells. It must be stored dry and free of dust and vibrations. The permissible transport and storage temperature range is -20°C to +80°C. The rotor can be stored in either a horizontal or vertical position.

10.2 Stator

Lifting and transporting



Damage caused by improper lifting!

⇒ The stator may only be lifted and transported in a vertical position before it is screwed onto the spindle housing! Parallel chains or ropes with suitable transport rings must be used for this purpose.

This keeps the stator from bending and prevents damage to the fit on the cooling jacket, which would make the stator unusable for mounting. Ring screws according to DIN 580 are suitable transport rings (see Fig. 10-2).

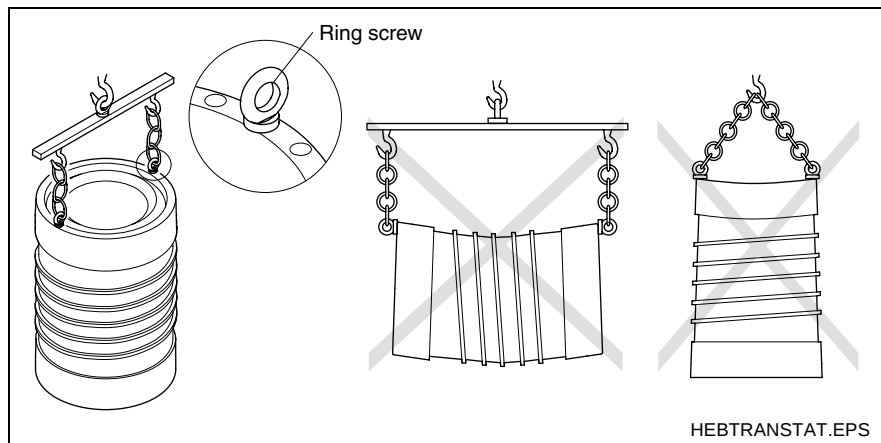


Fig. 10-2: Lifting and transporting the stator

Storage The stator must be stored dry and free of dust and vibrations. The permissible transport and storage temperature range is -20°C to $+80^{\circ}\text{C}$.

Note: The stator may only be stored in a vertical position!

It receives its final rigidity only after it is installed in the spindle housing. If it is stored in a horizontal position, the fit on the cooling jacket may be damaged!

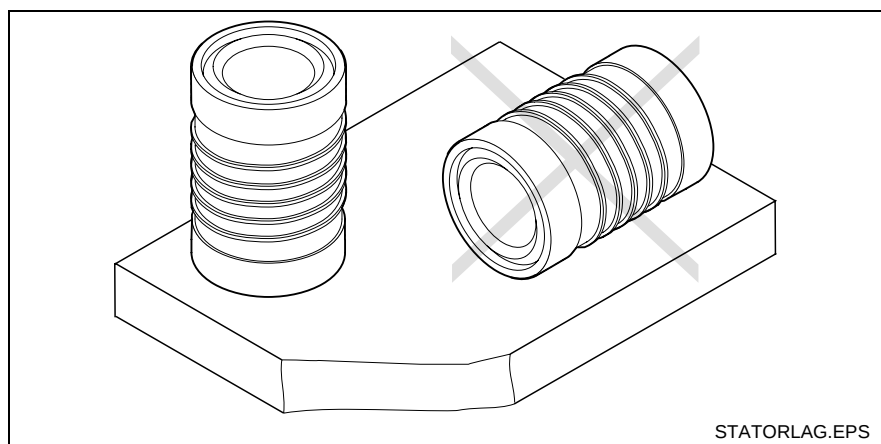


Fig. 10-3: Storing the stator

10.3 Condition at delivery

Depending on what is ordered, either an entire 1MB frameless spindle motor is delivered or only individual components (stator, rotor).

The items are delivered either on a palette or in a skeleton box. The rotor and the stator are packed separately in Styrofoam to prevent mechanical damage due to parts knocking together during transport.

If several frameless spindle motors or components are simultaneously ordered, then these are packed together, if possible.

For protection against inclement weather, a carton is pulled over the palette and affixed to it with retaining straps.

An envelope containing the delivery documents is attached to the carton.

There are also stickers on the packaging:

- 1 sticker with guidelines on the safe handling and transport of the delivery
- barcode stickers (the number depends on the contents) with information about:
 - the customer
 - the delivery note
 - the consignment
 - the carrier

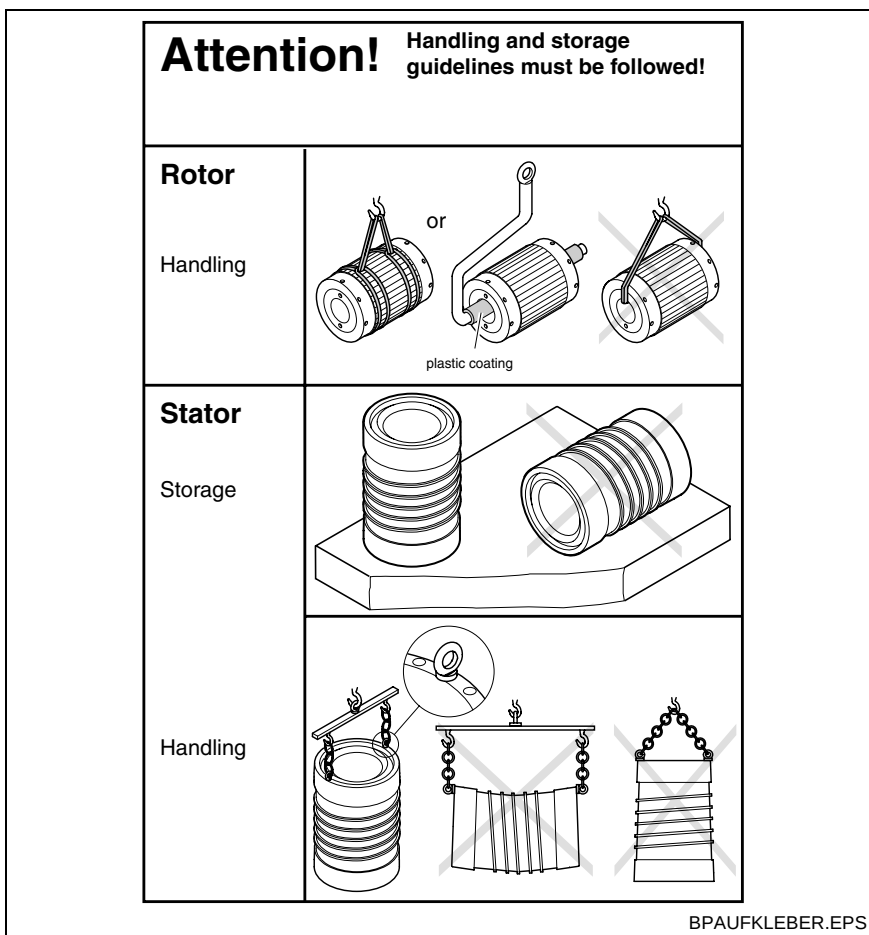


Fig. 10-4: Stickers on the packaging: guidelines on handling and transportation

There is no additional documentation unless specifically requested.

The retaining straps must be cut open to unpack the order without causing damage.



WARNING

Injuries due to uncontrolled movement of the retaining straps when cutting!

- ⇒ Wear protective equipment
- ⇒ Maintain a sufficient distance
- ⇒ Carefully release the retaining straps

10.4 Identification

All items delivered are listed by name and type designation on the delivery note. One copy of the delivery note is included for the entire delivery. If the contents of the delivery are contained within several packages, this is noted on the delivery note or can be seen on the waybill.

Bar code There is one barcode sticker each on the packaging for the rotor and the stator. The barcode sticker is used for the identification of the contents of each package and is needed for order processing.

Type plate Stator 1MS and rotor 1MR are each supplied with 1 type plate.
Attach the type plates to an easily visible location on the machine. In this way, you can read the motor data at any time without having to work in areas that are difficult to access.



Before sending questions to BOSCH REXROTH, always note the entire type plate and serial number of the affected products.

Rotor

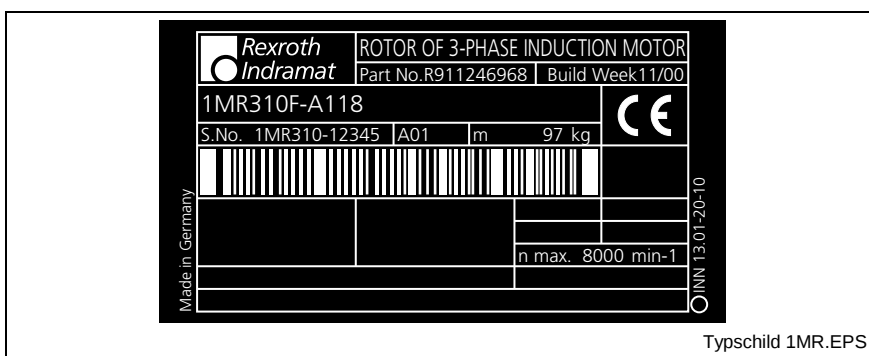


Fig. 10-5: Rotor type plate (example)

The following information has been struck into the rotor on one of its short-circuit rings:

- Type designation
- Serial No.
- Month and year of manufacture

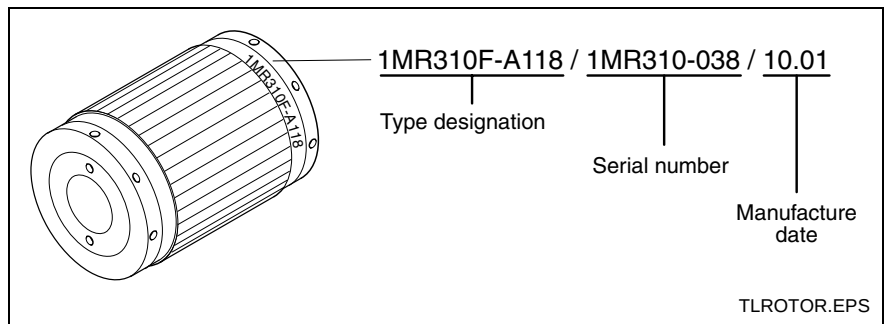


Fig. 10-6: Type designation on the rotor (example)

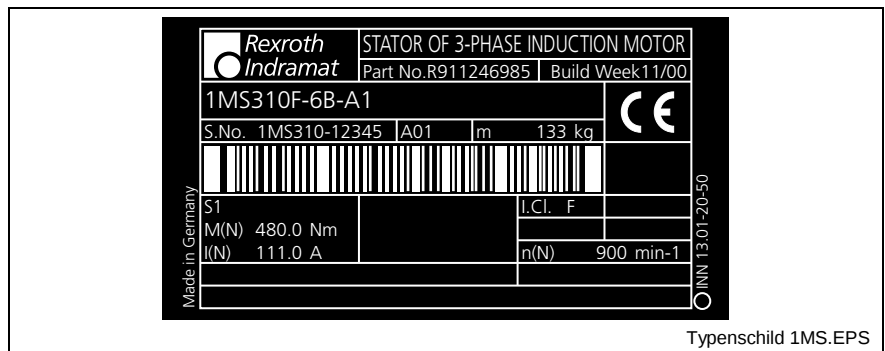
Stator

Fig. 10-7: Type plate on the stator (example)

The following information has been struck into the thick end of the stator on the inside of the cooling jacket:

- Type designation
- Serial number
- Month and year of manufacture

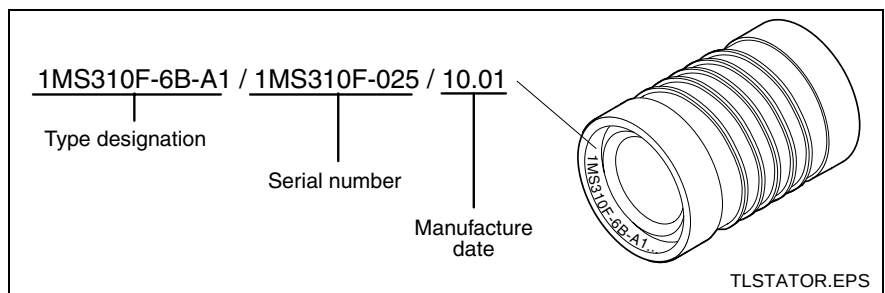


Fig. 10-8: Type designation on the stator (example)

11 Mounting Instructions

In addition to providing technical characteristics, this chapter describes how

- the rotor is mounted to the spindle,
- the rotor is to be removed from the spindle,
- the stator is built into the spindle housing and electrically connected,
- the motor spindle electrical connections are checked , and
- the stator is removed from the spindle housing.

Carefully executing the steps described here will ensure:

- problem-free assembly and disassembly of the constructional parts,
- the proper functioning of the frameless spindle motor

Safety notes The notes regarding safety listed in chapter 3 and in the following in this chapter absolutely must be heeded. They help to prevent accidents and damage to materials resulting from improper handling.

Additionally, special notes regarding safety are listed in the assembly guidelines. These can be found where there is increased danger or where it could possibly occur.

Obligation The basic procedures for mounting and removing the components is always the same. The procedure can vary, however, from that described here, depending on the construction of the spindle and its housing. These assembly instructions are therefore simply general in nature and must be adapted to suit the given demands. The assembly instructions of the builder of the spindle and its housing are binding and have priority over the procedures described here.

Assembly steps The procedures depicted below offer an overview of the individual assembly steps.

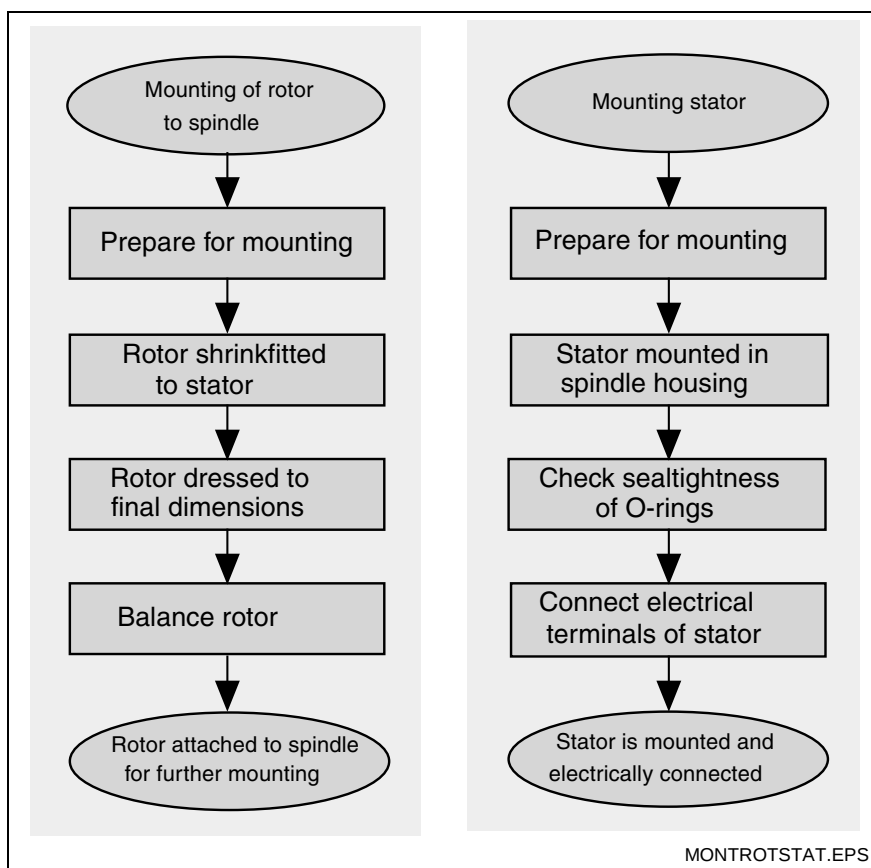


Fig. 11-1: Assembly procedures for rotor and stator

11.1 General Notes Regarding Safety

This section discusses general notes regarding safety in addition to those described in Chapter 3 "Notes regarding safety". It is required that they always be heeded.

- | | |
|-----------------------------------|---|
| Oil pump | Use only manually-operated oil pumps when removing the rotor from the spindle. Manually-operated oil pumps guarantee that the oil pressure will immediately drop to 0 bar in the event of leaks in the multiple die press group, the windings or the pump piping system. For safety reasons, the oil pump must be additionally equipped with a safety valve which prevents the oil pressure rising above 1500 bar. |
| Securing the threaded pins | The threaded pins in the rotor must be secured to keep them from loosening during operation and thereby endangering both machinery and personnel. Glue the threaded pins with LOCTITE for this purpose. See the gluing guidelines in section 11.3. |
| Accident prevention | <p>Appropriate safety clothing must be worn during assembly. There is, in particular, the danger of burns when shrinking the rotor onto the spindle. Heat-resistant clothing must be worn.</p> <p>Heed the accident prevention guidelines "Electrical plants and operational equipment" (VBG 4):</p> <p>Prior to working on live parts in electrical systems and on electrical equipment, disconnect the power and make sure it cannot be reconnected while work is being carried out. Prior to the initial start-up, the electrical systems and electrical equipment must be checked by a qualified electrician to see if they function.</p> <p>The user is responsible for proper grounding of the entire system. To prevent accidents, protective measures must be taken against direct and indirect contact with live parts. See the notes in DIN VDE 0100, Part 410.</p> |
| Handling and transport | The handling and transport regulations in Chapter 10 "Handling, Transport and Storage" absolutely must be heeded. |

11.2 Aids for Mounting and Removal

Tools and equipment	Mount rotor to spindle	Dismount rotor from spindle	Mount stator	Elec. test of motor spindle	Remove stator
Crane (size sufficient for weight of part)	x	x	x		x
Lifting device (sufficient size for weight of part)	x	x	x		x
Work fixture for attaching rotor ¹⁾	x				
Warming cupboard (+200°C minimum)	x				
Lathe (to final dress rotor design "C")	x				
Balancing equipment	x				
Test assembly to check concentricity	x				
Clamping device for fixing spindle-rotor ¹⁾	(x)				
Compressed air device	(x)				
Oil pump (max. 1500bar) with accessories ¹⁾	(x)	x			
Arresting device ¹⁾		x			
Drilling device			x		
Water pump to check tightness (up to 6 bar)			x		
Ohmmeter				x	
High-voltage testing equipment				x	
Inductance measuring equipment				x	
Torque wrench up to 35Nm			x		
Conventional tools and cleaning equipment	x	x	x		x
Aids					
LOCTITE 243			x		
LOCTITE 620	x				
LOCTITE quick clean 7061	x		x		
LOCTITE activator 7649	x		x		
Mineral oil: viscosity 300 mm²/s at 20°C	(x)				
Mineral oil: viscosity 900 mm²/s at 20°C		x			
Oil, conventional type, for lubrication	x				
Grease, conventional type	x		x		
Vaseline			x		
Coolant			x		
¹⁾ See explanations on next page. (x) Only applies to mounting errors					

Tools.EPS

Fig. 11-2: Aids for assembly/disassembly

Note: Use only suitable tools and equipment!

Explanations Work fixture for mounting the rotor:

The fixture must be heat-resistant up to at least +200°C; it must also be able to support the weight of both the rotor and spindle. In addition, it must create a level and horizontal surface for the rotor. An example for such a design is shown below.

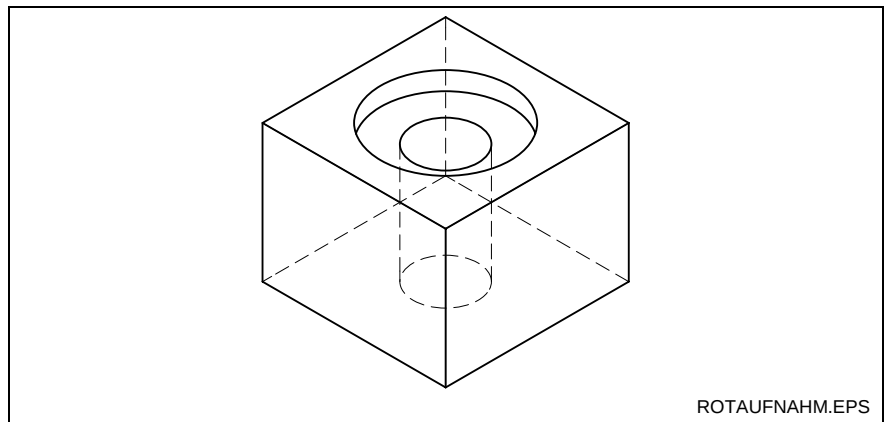


Fig. 11-3: An example of a work fixture for mounting the rotor

Manually-operated oil pump and accessories:

Oil pressure = 1500 bar with a safety valve; the connective winding size of the high-pressure duct = M6 or M4x0.5 (depending upon the type of rotor)

Oil pumps and accessories can usually be obtained from the manufacturers of roller bearings.

Clamping device for spindle-rotor attachment:

If the spindle is deformed once the rotor has been fitted by shrinking, then a clamping device, among other things, is needed to correct this deformation. This device must firmly hold the rotor into place on the spindle and prevent any axial movement of the rotor. Fig.11-15 illustrates an example.

Arresting device:

When removing the rotor from the spindle, it can suddenly slide off the spindle. The spindle must therefore be equipped with an arresting device. Fig.11-15 illustrates an example. The dimensions of the arresting device must be noted (see Fig.11-16).

11.3 Securing Screws with LOCTITE ¹⁾

General LOCTITE is a plastic gluing agent that is applied in liquid form to the parts to be assembled. The agent retains its liquid form as long as it has contact to oxygen. Only after the individual parts have been mounted does it change from its liquid state to a solid plastic state. This chemical transformation takes place because of the lack of air and the contact with metal. A form-fitting connection is created. It is resistant to shocks and vibrations.

Setting activator 7649 reduces the setting time of the gluing agent.

LOCTITE 620 is heat-resistant up to +200°C, LOCTITE 243 up to +150°C.

Gluing Proceed as follows:

1. Remove metal shavings and dirt from the threaded hole and screw / threaded pin.
2. Remove all oil, grease and dirt from the threaded hole and screw/threaded pin with LOCTITE quick cleaner 7061. All threads must be absolutely free of rust.
3. Spray LOCTITE activator into the threaded hole and let dry.
4. Wet the same threaded hole uniformly and thinly with LOCTITE over its entire thread length.
5. Screw in the matching screw / threaded pin.
6. Allow the glued connection to set. Heed the setting times in Fig. 11-4.

Securing screw connections with LOCTITE in tapped blind holes:

The gluing agent must be applied in the threaded hole and not to the screws. This prevents any air from pressing the glue out once the screw or threaded pin is screwed in.

	Completely set	Partially set without activator	Partially set with activator 7649
LOCTITE 243	~ 12h	15-30 min	10-20 min
LOCTITE 620	~ 24h	1-2h	15-30 min

Fig. 11-4: Setting times for LOCTITE glues

Releasing the connection The connection is undone by removing the screw or the threaded pin in the usual way with a key.

LOCTITE 620 has a breakaway torque of 20-45 Nm; for LOCTITE 243 it is 14-34 Nm (acc. to DIN 54 454). Blowing hot air on the screwed joint reduces the breakaway torque.

After the screw / threaded pin has been removed, it is necessary to remove any gluing agent residue from the hole (e.g., by shaving the thread).

¹⁾ This section has been checked by LOCTITE Deutschland for accuracy and approved for publication.

11.4 Rotor Installation Principles

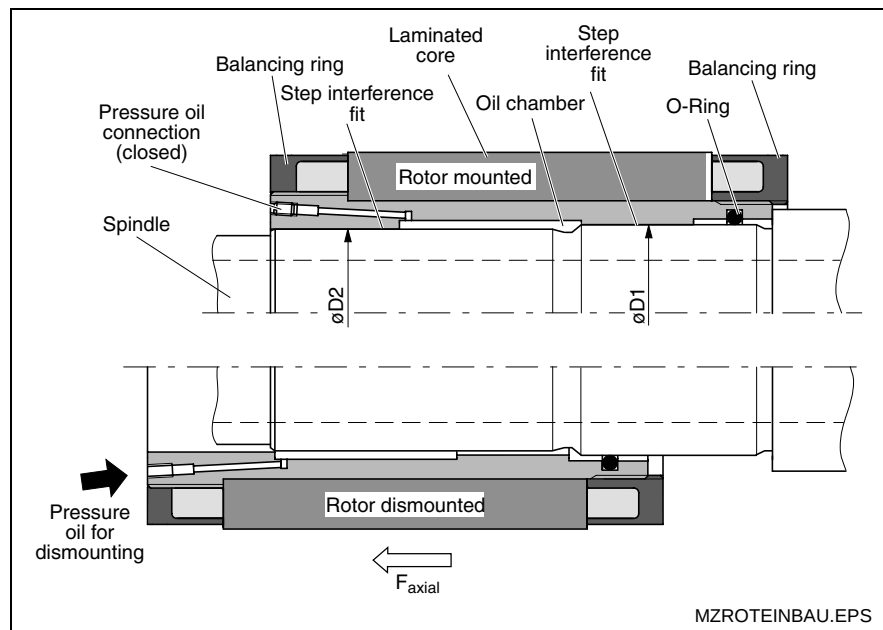


Fig. 11-5: Rotor installation and functional principle of the multiple die press group

Rotor The rotor consists of a sleeve and a laminated core with balancing rings located on the front. The spindle has two fitting surfaces arranged next to each other; these have slightly graduated diameters ($\varnothing D1 > \varnothing D2$). The rotor and spindle are frictionally engaged by the multiple die press group. The graduated fitting surfaces align the mounted rotor to the spindle; they are required so that the rotor can be removed without damage.

The spindle construction in the area of the multiple die press group must correspond to the information in the dimension sheets of the corresponding motor in chapter 5.

The rotor is attached by shrinkfitting it onto the spindle; the oil-pressure process is used during removal.

Assembly/removal The rotor is heated up to approximately 200 °C prior to assembly. Due to the material expansion, the fittings expand to fit diameters D1 and D2. The rotor and spindle can be joined without force.

Oil under pressure is injected into the multiple die press group during removal. This creates an axial force with which the rotor can slide off the spindle as soon as there is an oil film between the fitting surfaces to separate them. The multiple die press group loosens at diameter D1 first. The O-ring keeps the oil from running out.

Balancing After assembly, the rotor is balanced to the necessary vibration severity grade (DIN VDE 0530, Part 14). To achieve equilibrium of the rotor, threaded pins are radially screwed into the circumference of the balancing ring and secured using glue.

11.5 Mounting the Rotor to the Spindle

Rotor Parts / Scope of Delivery

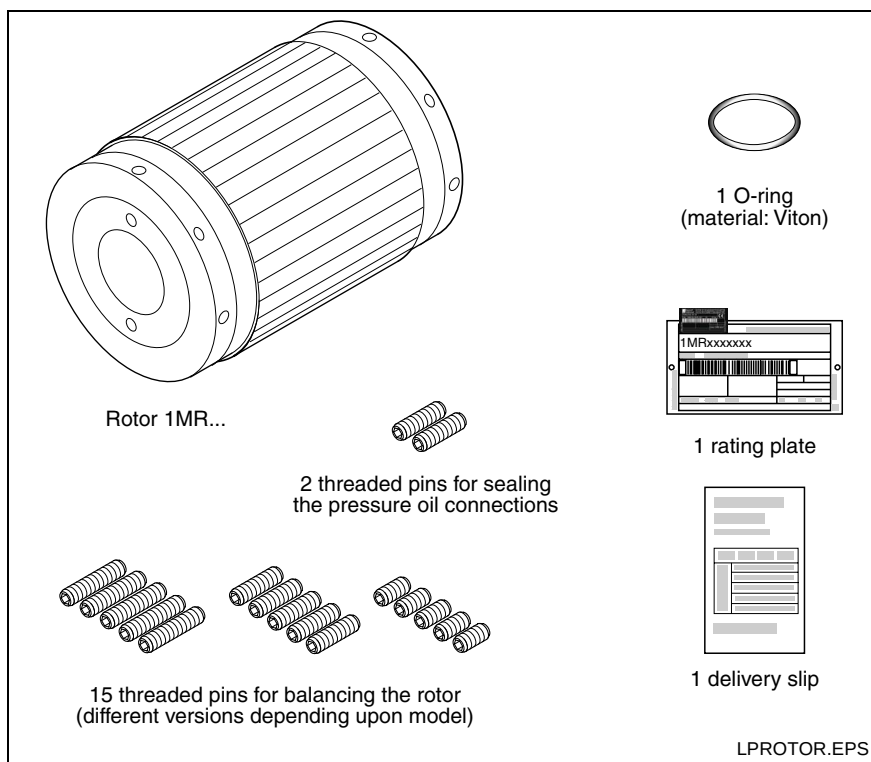


Fig. 11-6: Scope of delivery of the rotor

Before Mounting

Mounting should be carried out in a dry, dust-free environment. The following preparatory measures should be taken for this purpose:

- Check to see whether all parts of the delivery are present
- Visually check the rotor for any damage.
- Mount the type plate in a conspicuous position on the spindle housing.
- Make sure that the bevels and edges of the spindle press fits are free of burrs. Remove burrs if necessary.

Note: **The laminated core is protected against corrosion!**

The rotor has been coated with a red corrosion protection lacquer at the factory for transport and storage.

- Remove the protective lacquer before assembly.
- Wear suitable protective clothing.
- Detergents that are used must be completely removed before heating the rotor in a heating cabinet.

If necessary, reapply corrosion protection to the rotor after assembly.

- The inside diameter of the rotor, the oil connection drill holes and the press fits on the spindle must be thoroughly cleaned of dirt, dust and metal shavings.

- Lubricate the O-ring and insert it into the groove in the rotor. Do not twist the O-ring! Make sure everything is clean.
- Apply oil to press fits $\varnothing d1$ and $\varnothing d2$ on the spindle.

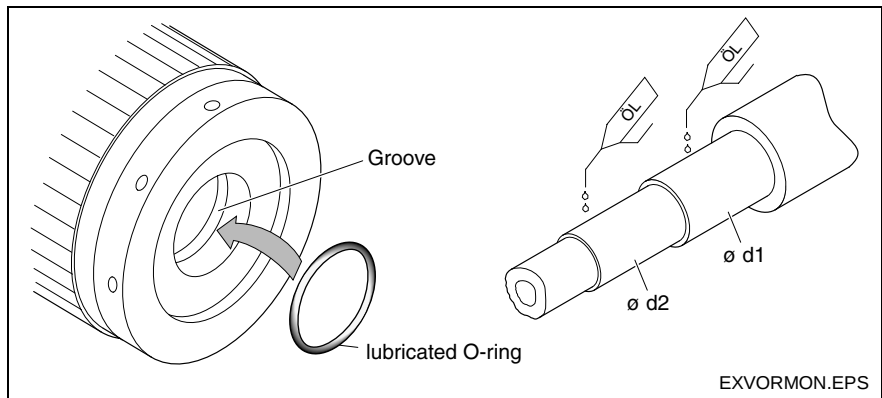


Fig. 11-7: Preparing the rotor and spindle for assembly

- Prepare the work fixture for the rotor so that the rotor is supported vertically and can take up the spindle.

Shrinkfitting the Rotor onto the Spindle

1. Heat the rotor in the heating cabinet to at least +180°C, but no more than +200°C.

Note: If the rotor is not heated to at least +180°C, the spindle will get stuck in the rotor during the shrinkfitting process before reaching its final position.



WARNING

Burns due to hot components with temperatures above 50°C!

- ⇒ The rotor is hot! Contact leads to serious burn injuries!
 - ⇒ Wear protective clothing and safety gloves!
-

2. Place the rotor into the prepared work fixture. The O-ring must be at the top.
3. Pick the spindle up and quickly slide it into the rotor.

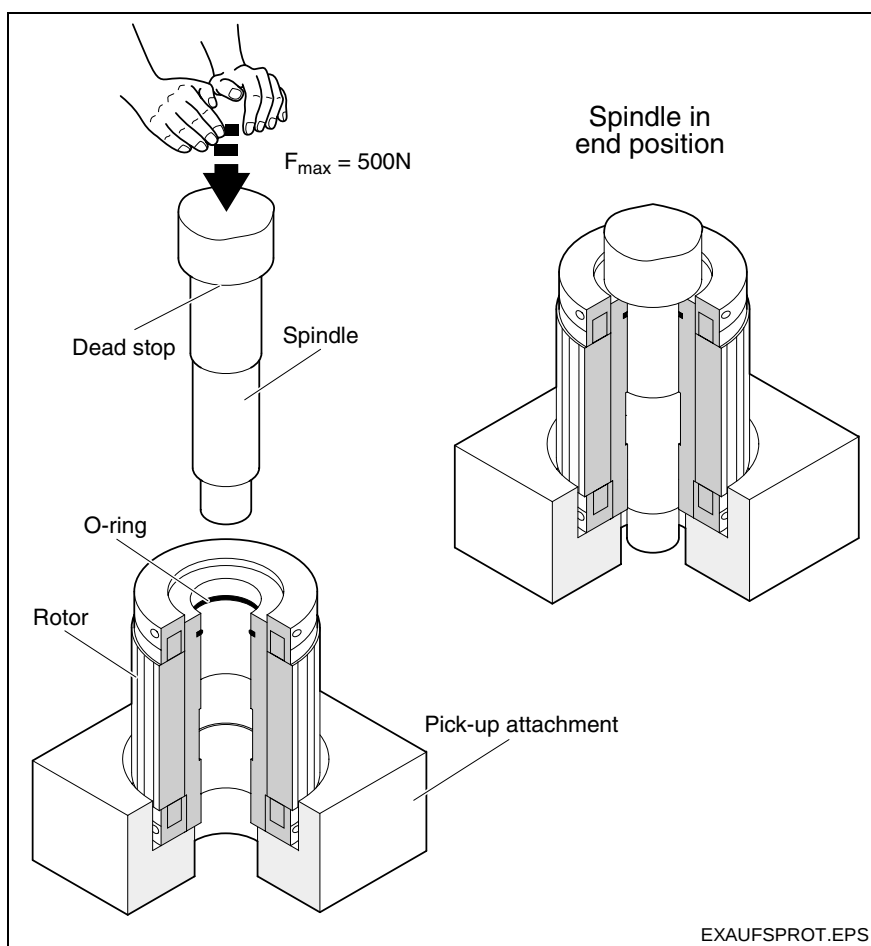


Fig. 11-8: Assembling the rotor and spindle

The spindle usually slides into its end position (final stop on the spindle) without requiring additional force. If it does not slide into its end stop by virtue of its own weight, the spindle can be forced into place in the rotor with no more than 500 N (the force equal to the body weight of the mechanic).

4. Let the rotor and spindle cool to room temperature.
5. Check whether the rotor has properly shrunk onto the spindle:
 - Visually check whether the spindle is in its final position in the rotor
 - Check the concentricity of the spindle:

Check whether the concentricity of the spindle is still as high as it was prior to shrinkfitting. If the concentricity has deteriorated, the spindle is slightly deformed. This deformation is caused by stress which can occur in the multiple die press group during cooling.

Note: If the spindle is not in its final position and the necessary concentricity can not be achieved, the measures described in this chapter in the "Measures to be taken in the case of faulty assembly" section must be taken.

6. Use the threaded pins to close the pressure oil connections in the rotor. This means screwing the threaded pins in all the way and securing them against rotation with LOCITE 620 (for gluing guidelines, see section 11.3). The threaded pins must be glued into place in such a way that they completely seal the connections against oil pressure.

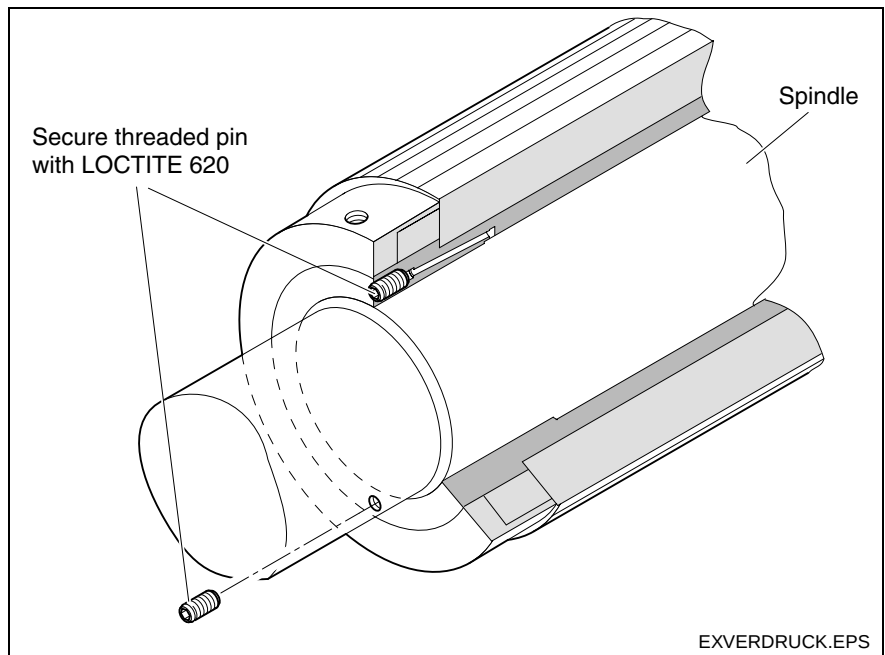


Fig. 11-9: Sealing the pressure oil connections

Dressing the Rotor to its final dimensions (only for Rotor Design "C")

Once the rotor and the spindle are firmly attached, the outside diameter of the rotor within the zone of the laminated core must be dressed dry (without coolant or cutting liquid). The prescribed final dimension of the outside diameter depends on the motor type; it is listed in the corresponding dimension sheets in Chapter 5.

When dressing, make sure that the maximum deviation of concentricity to bearing seats A and B does not exceed the prescribed value.

The value for the maximum deviation of concentricity for the various motor types are listed in the relevant dimension sheets.

Note: Do not grind the rotor and do not dress it when it is wet!
No material may be removed from the short-circuit rings or the balancing rings.

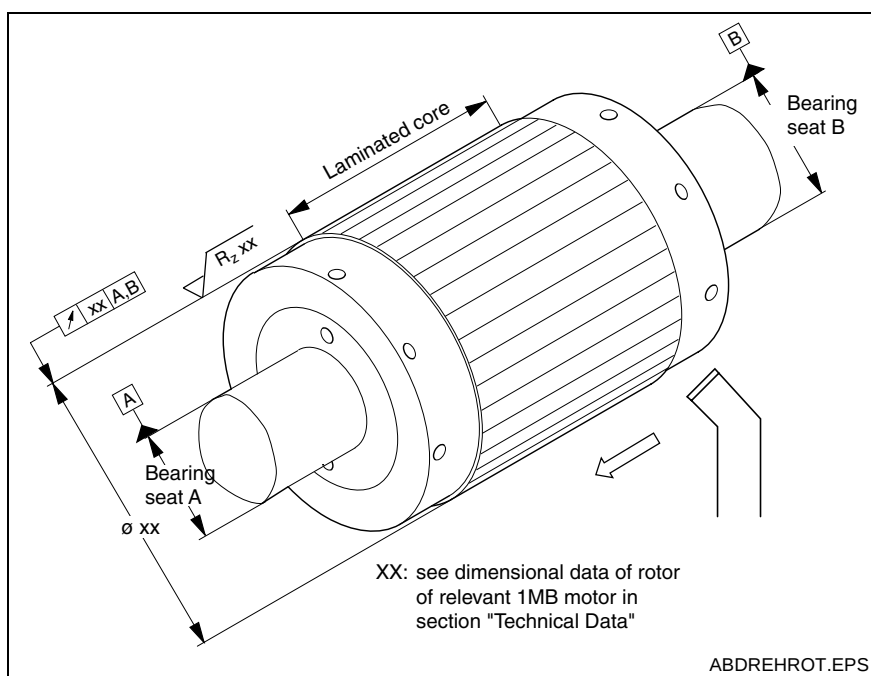


Fig. 11-10: Dressing the rotor

Note: The final dimension to which the outside diameter is to be dressed absolutely must be maintained.
If too much material is machined off, the characteristic curve of the drive is altered.

Balancing the Rotor

The rotor must be balanced with the spindle to achieve the desired vibration severity grade of the spindle. There are balancing rings with tapped holes on the front of the rotor. Threaded pins should be screwed in, as needed, for balancing. Table 11-12 lists the threaded pins that are supplied.

The vibration severity grade needed depends on the finishing accuracy of the motor spindle; this accuracy is determined by the builder of the motor spindle.

Note: No material may be removed from the balancing rings when balancing the spindle!

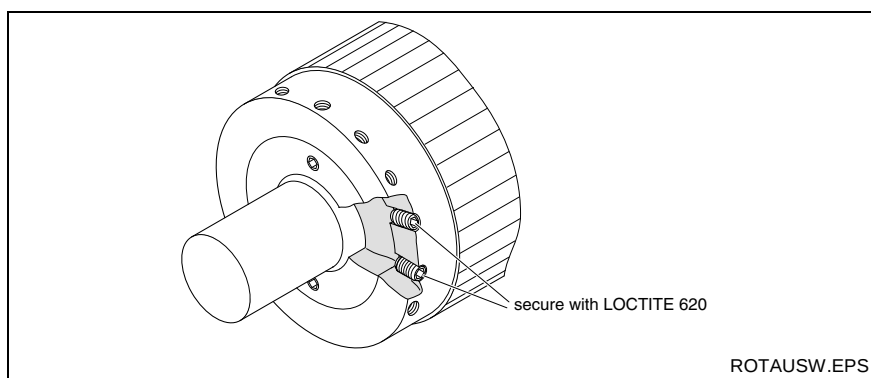


Fig. 11-11: Balancing by inserting threaded pins

Note: The threaded pins can be inserted to a greater or lesser degree, depending on the mass equilibrium required. They may not, however, protrude out of the balancing ring! It is not necessary to completely insert them!

Make sure that the threaded pins cannot become loose on their own. To do this, glue them with LOCTITE 620 - see Fig. 11-3 for gluing guidelines. Heed the setting times with the activator! Do not use the activator if it is not necessary.

Threaded pin DIN 913	Parts / 1MR ...									Weight / piece (g)
	140	160	200	240	241	242	270	310	375	
M5x5	10									0.44
M6x6		5	5			5	5			0.76
M6x8		5	5			5	5			1.11
M6x12			5			5	5			1.81
M8x8				5	5					1.89
M8x10				5	5					2.52
M8x16				5	5					4.41
M10x10								5	5	3.78
M10x12								5	5	4.78
M10x20								5	5	8.76

Fig. 11-12: Summary of the threaded pins supplied

Measures to be Taken in the Case of Faulty Assembly

Error:

Spindle gets stuck in the rotor during the shrinkfitting process before reaching its final position.

Proceed as follows:

1. Let the rotor and spindle cool.
2. Seal one of the two pressure oil connections on the rotor with a threaded pin. This means screwing the threaded pin in all the way and securing it against turning with LOCITE 620 (for gluing guidelines, see section 11.3). The threaded pin must be glued into place in such a way that it completely seals the connection against oil pressure.
3. Force the rotor off of the spindle with the help of the pressure oil (as described below under "Removing the rotor from the spindle").
4. Check the tolerances of the press fits.
5. If necessary, remove burrs from the inside diameter of the rotor and at press fits $\varnothing d1$ and $\varnothing d2$ of the spindle.

Note: Both the spindle and the rotor must be absolutely free of burrs!

6. Shrinkfit the rotor onto the spindle again.

Error:

The spindle is warped after the rotor has been shrinkfitted.

Tension in the multiple die press group can occur during shrinkfitting. These can cause spindle deformations in the micrometer size range. This tension and the deformations are removed by forcing pressure oil into the multiple die press group.

Proceed as follows:

1. Let the rotor and spindle cool.
2. Seal one of the two pressure oil connections on the rotor with a threaded pin. This means screwing the threaded pin in all the way and securing it against turning with LOCITE 620 (for gluing guidelines, see section 11.3). The threaded pin must be glued into place in such a way that it completely seals the connection against oil pressure.
3. Using appropriate assembly tools, clamp the rotor and spindle to each other in such a way that the rotor is firmly held in position on the spindle.

Note: The rotor must not be permitted to shift axially on the spindle while the pressure oil is being injected.

4. Connect the oil pump.

Use oil with a viscosity of $300 \text{ mm}^2/\text{s}$ at $+20^\circ\text{C}$! This ensures that the oil will quickly and completely flow out after "floating".

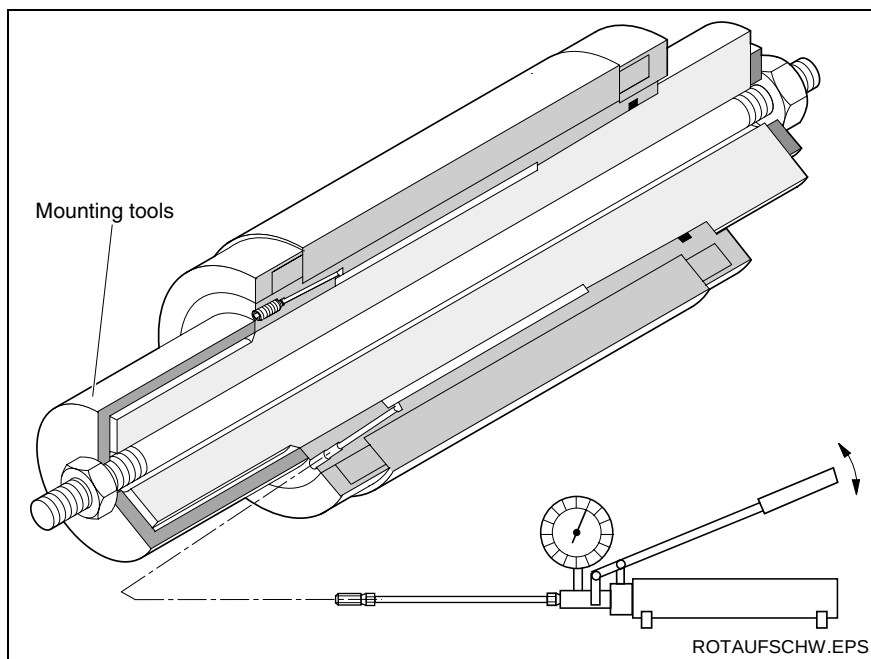


Fig. 11-13: "Floating" of the rotor

5. Pump oil into the multiple die press group.

Note: Oil is exuded!
Have a collecting pan ready.

Slowly increase the oil pressure until oil begins to leak out of the coil end of the interference interface.

A separating oil film forms between the rotor and spindle. Due to this "floating" of the rotor on the spindle, the tension that resulted from shrinkfitting is released.

6. Eliminate all pressure from the oil pump, supply lines and interference fit.
7. Open both pressure oil connections.
8. Bring the spindle with the clamping device into a vertical position and, using compressed air, force the oil out of the multiple die press group (see Fig.11-14).
9. Let oil completely run out of the multiple die press group.

Note: The multiple die press group can be placed under a full load only after 24 hours!

10. Seal both pressure oil connections with threaded pins and secure them with LOCTITE 620.

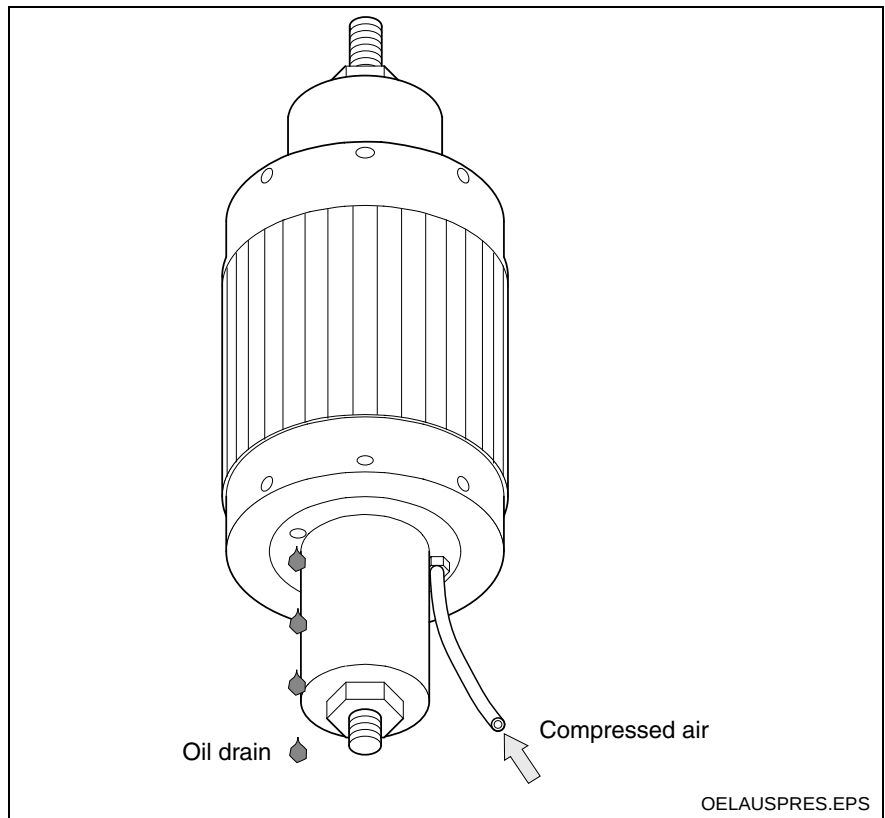


Fig. 11-14: Using compressed air to force oil out

11.6 Removing the Rotor from the Spindle

In the following cases, it may be necessary to remove the rotor from the spindle:

- damage to the bearings on the spindle
- rotor damage
- assembly mistakes

Note: The angular position of the rotor must be marked on the spindle before removal!

It is necessary to shrinkfit the rotor onto the same spindle, at the position marked, during reassembly. This maintains the concentricity tolerance of the outside rotor diameter to the bearing seats.

Proceed as follows:

1. Mark the angular position of the rotor on the spindle.
2. Open a pressure oil connection.

The second connection must remain closed. If necessary, secure it with one of the supplied threaded pins. This means screwing the threaded pin in all the way and securing it against turning with LOCITE 620 (for gluing guidelines, see Chapter 11.3). The threaded pin must be glued into place in such a way that it completely seals the connection against oil pressure.

3. Mount the end stop (example in Fig.11-15). Note the mounting dimension (A) for the stop.

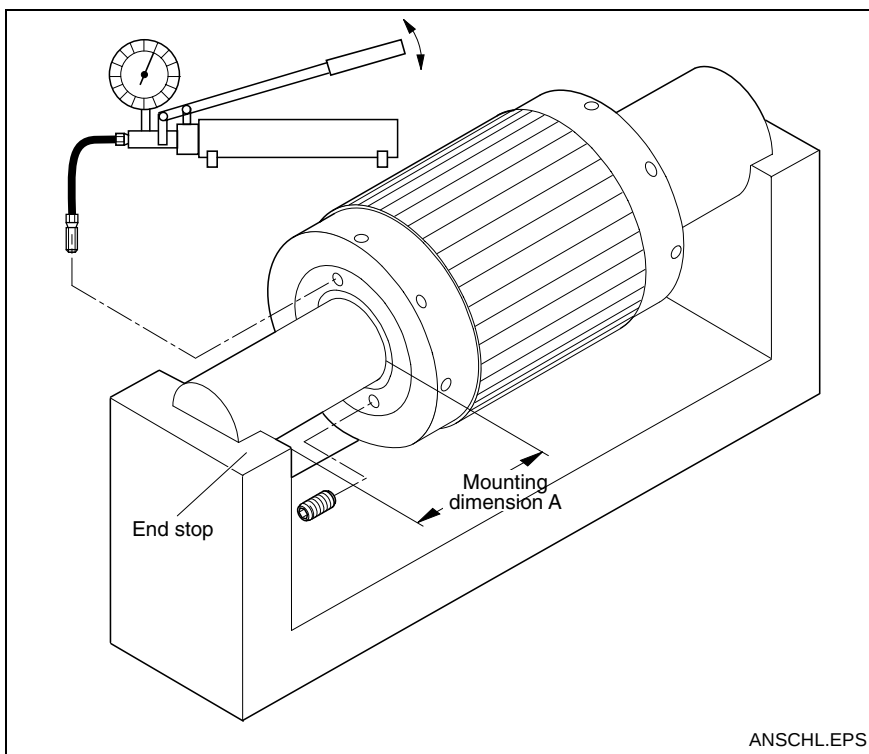


Fig. 11-15: Example for an end stop for use during removal

Rotor	Measurement A (mm)
1MR 140	min. 60
1MR 160	min. 70
1MR 200	min. 80
1MR 240	min. 80
1MR 241	min. 80
1MR 242	min. 80
1MR 270	min. 90
1MR 310	min. 90
1MR 375	min. 110

Fig. 11-16: Mounting dimension A for various rotor types

4. Connect the oil pump.

Use oil with a viscosity of $900 \text{ mm}^2/\text{s}$ at $+20^\circ\text{C}$!

**WARNING****Risk of injury from sudden rotor movements!**

⇒ The rotor can suddenly slide off the spindle when oil is pumped into the multiple die press group.

⇒ The spindle must be equipped with an arresting device when pumping oil in.

5. Pump oil into the multiple die press group.

Note: Oil is exuded!

Have a collecting pan ready.

Slowly increase the oil pressure until the axial force affecting the multiple die press group permits the rotor to slide off the spindle.

6. If oil is already leaking on the coil end of the multiple die press group and the rotor still cannot be dislodged from the spindle, gently tap the rotor in the direction of the end stop with a plastic hammer.

11.7 Stator Installation Principles

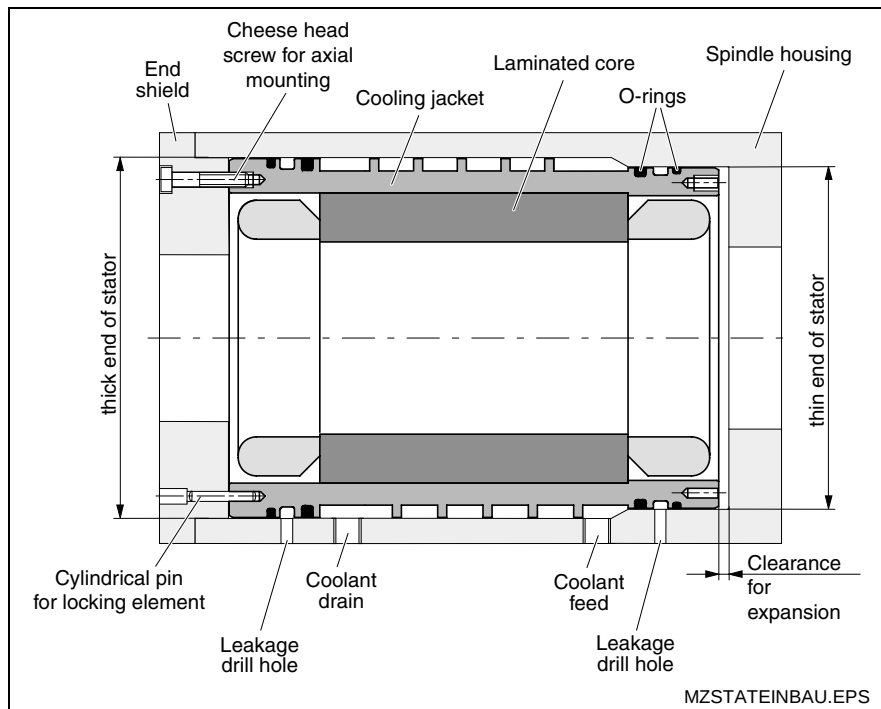


Fig. 11-17: Stator installation

Stator The stator is made up of a laminated core, with end windings located on the front, and the cooling jacket. The outside diameter of the cooling jacket is stepped. As a result, the ends of the stator are called thick and thin stator ends.

Construct the mounting drill hole in the spindle housing according to the dimension sheets of the corresponding motor in Chapter 5, "Dimension sheets".

Attaching the stator The stator is axially mounted in the motor spindle at either the thick or thin end of the stator; it is then secured against movement. Windings for axial mounting and drill holes for cylindrical pins (not for 1MB 140) are fixed to the front as protection against torsion.

There must be a clearance of at least 1mm between the stator and the spindle housing on the end opposite the stator end so that the stator can expand in length. This expansion of length is caused by the stator heating up while the motor spindle is operating.

The stator is light in weight and small in size. Therefore, it does not achieve its final flexural strength until it has been built into the spindle housing.

Cooler The spiraled slot worked into the cooling jacket creates a cooling channel together with the spindle housing; this channel is sealed at both ends with an O-ring. There is a wraparound leakage groove between the O-rings. A hole must be drilled at the lowest point of the spindle housing for any leaking coolant to be able to run off.

Corrosion protection The spindle housing must be protected against corrosion. A suitable coolant or coolant additive can be used for this purpose.

Further information for dimensioning and selecting a liquid cooling system is provided in the documentation "Liquid cooling of Indramat drive components" Mat. No. R911265836.

Electrical connection The power terminal is brought out through one of the end windings of the stators. There is also at least one NTC thermistor in this end winding; this measures the winding temperature through the control device.

The power terminal and the NTC thermistor are conducted together as a cable gland through a tube. Depending upon how it is ordered, the cable gland can be located at either the thick or thin end of the stator.

When bringing the cable through the spindle housing, note the following:

- the bending radius of the cable gland must not be less than outlined (see the Chapter 4 "Technical data") and
- the edges of the drill hole in the spindle housing must be rounded off.

11.8 Installing the Stator in the Spindle Housing

Stator Parts / Scope of Delivery

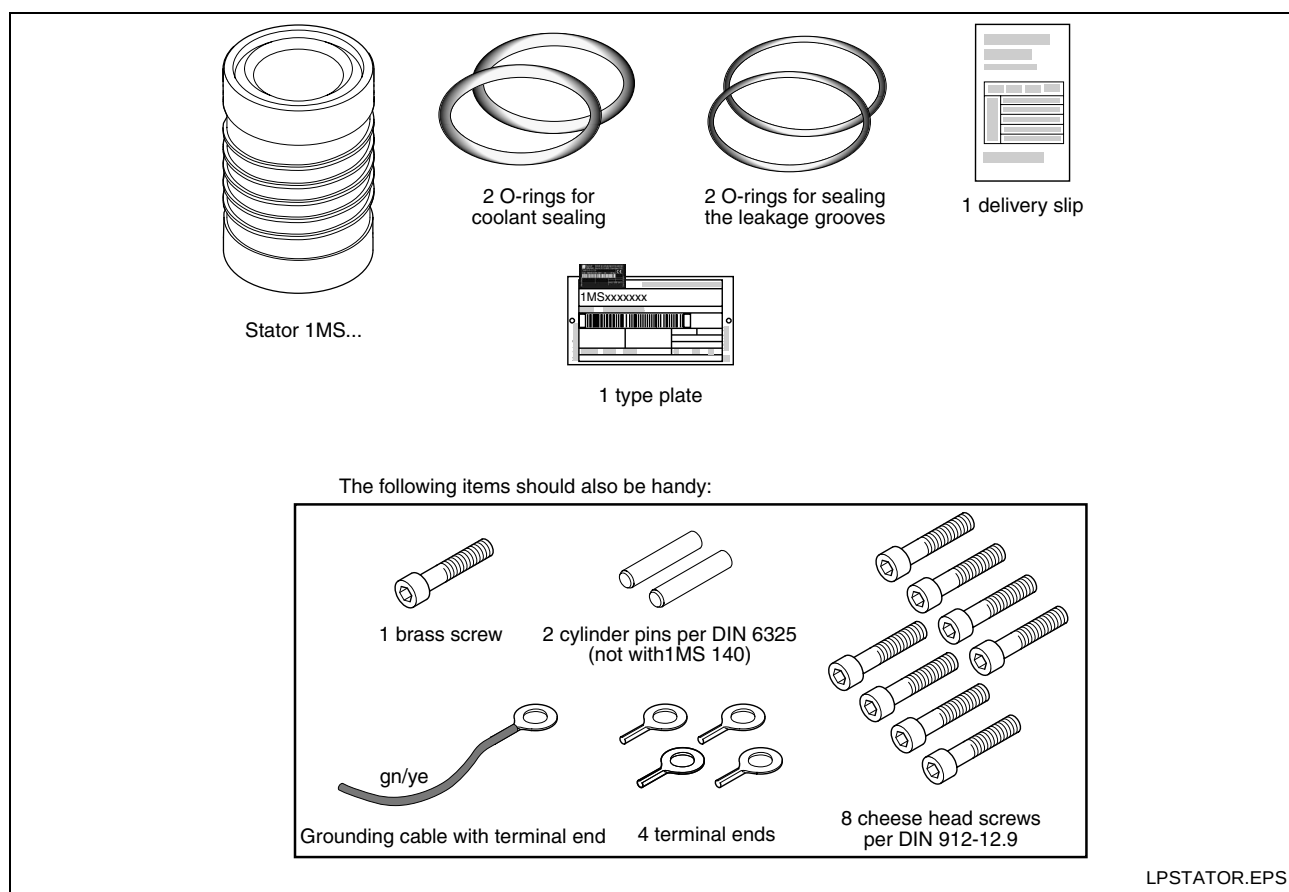


Fig. 11-18: Scope of delivery of the stator and additional materials

Before Mounting

Installation should be carried out in a dry, dust-free environment. The following preparatory measures should be taken for this purpose:

- Check to see whether all parts of the delivery are present.
- Have additional materials ready. The precise dimensions of these materials are noted in the construction drawings.
- Visually check the stator for any damage.
- Mount the type plate in a conspicuous position on the spindle housing.
- Check to make sure that the drill holes for the connections on the spindle housing are free of burrs; remove these if present.

Note: The inside edges of the drill holes (coolant connections and leakage drill holes) must be absolutely free of all burrs so as not to damage the stator during installation.

- Remove dirt, dust and metal shavings from the O-ring groove on the stator.

Installing the Stator in the Spindle Housing

There are tapped holes on both ends of the stator for attaching the stator to the spindle housing.

Note: It can be mounted to either the thick or thin end of the stator, but not to both!

Note: The basic procedure for attaching the stator to the housing is always the same. The procedure can vary slightly, however, from that described here, depending on the construction of the spindle housing. The following describes how the stator is mounted to the back side of the end plate.

Proceed as follows:

1. Lubricate the O-rings.
2. Insert O-rings (item 1 acc. to the stator accessory list) into the grooves located further inside (coolant seal). Do not twist the O-rings! Make sure everything is clean.
3. Insert O-rings (item 2 acc. to the stator accessory list) into the grooves located further outside (leakage groove). Do not twist the O-rings! Make sure everything is clean.

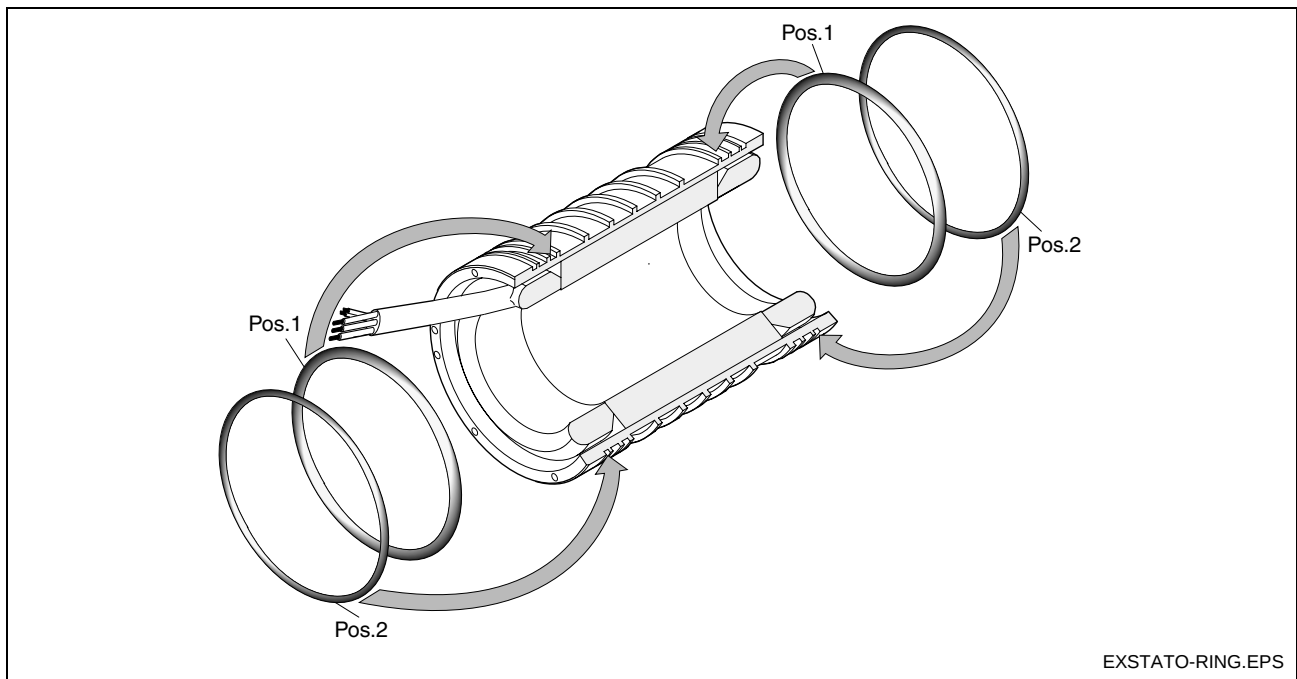


Fig. 11-19: Installing O-rings

Note: The O-rings for sealing the leakage groove and for the coolant seal have the same dimensions in several motor types!

4. Let the stator glide into the spindle housing so that it is centered. Use parallel chains or ropes to lift the stator.

Note: Do not use the cable gland as a mounting aid and do not pull or push the cable gland in any way!
The transport and handling regulations absolutely must be observed!

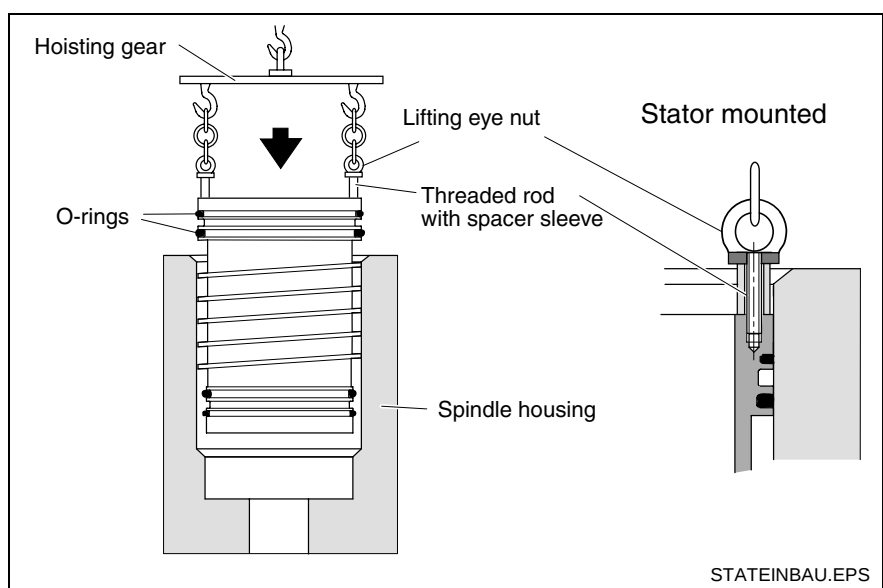


Fig. 11-20: Installing the stator into the spindle housing

5. Push the stator into its final position. Use suitable tools if assembly is difficult.
6. Screw the stator onto the front of the end plate. Using a torque wrench, uniformly tighten the screws. The tightening torques are listed in the relevant construction diagrams.

Secure the screws with LOCTITE 243; see the gluing guidelines in section 11.3)

7. Pin the stator to the end plate (not for 1MS 140).

The drill holes for the cylindrical pins in the cooling jacket of the stator are rough-drilled. They need to be enlarged to the size listed in the construction diagrams.

Checking the Seal-Tightness of the O-Rings

Once the stator has been installed, the seal-tightness of the O-rings should be checked.

Proceed as follows:

1. Fill the coolant groove between the cooling jacket and spindle housing with coolant.
2. Seal one of the coolant connections in the spindle housing with a screw plug.
3. Connect a pump with pressure indicator and pressure regulator for the coolant to the second connection.
4. Position the spindle housing in such a way that the drains are now at the lowest point (bottom).
5. Pump in the coolant and slowly increase the pressure from 0 to 6 bar.
6. Once 6 bar have been reached, watch the drain for 10 minutes to see whether any coolant is leaking.

Note: If coolant is leaking from the drill holes, replace the O-rings. Locate and eliminate the cause of the defective O-rings.

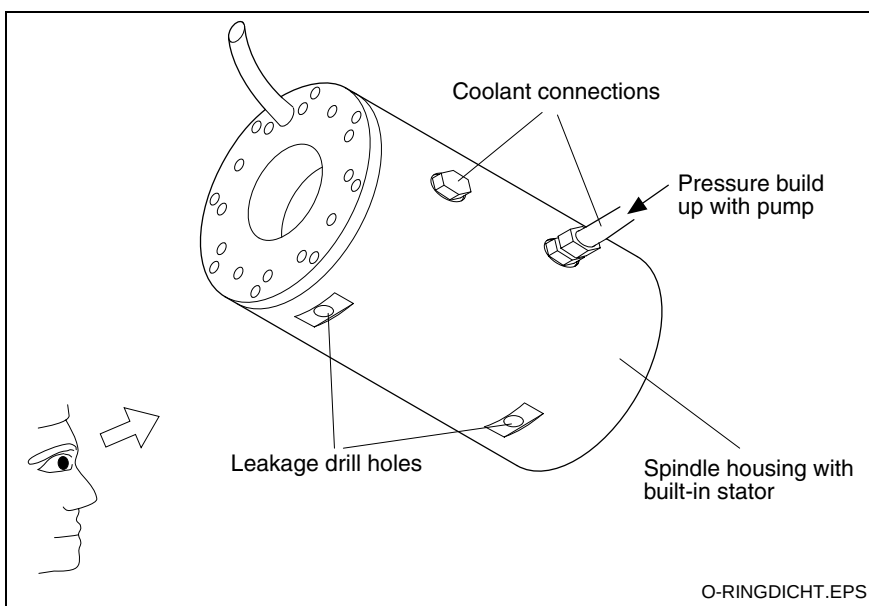


Fig. 11-21: Checking the seal-tightness of the O-rings

Electrical Connection of the Stator

A 1.5 m cable gland is attached to the stator when it is delivered. It is encased in a protective tube and is made up of:

- three power conductors (labeled U,V and W),
- two wire pairs for the two NTC thermistors in the end winding.

Only one of the two NTC thermistors is connected to the control device. The other is only a reserve. Its functioning is not guaranteed.

Before connecting the NTC thermistor, check to see whether it functions. For this purpose, the resistance of the thermistor is measured at room temperature with an ohmmeter. If the value measured equals 30-50 K Ω , the NTC thermistor is operational and can be used.

All lines are connected either to a flange socket (Indramat IN192) or a terminal box. Both the flange socket and the terminal box must be attached directly to the spindle housing.

Note: When routing the cable gland to the terminal box or flange socket, do not permit the bending radius to fall below the permissible value!

The edges of the through-holes may not be sharp!

Attaching the grounding cable to the spindle housing

The permissible bending radius depends on the diameter of the cable gland of the corresponding motor type; it is listed in the dimension sheets in this documentation.

The ground terminal should be attached to the spindle housing as depicted in Fig.11-22. The stator is grounded to the end plate via a screwed connection.

The minimum cross-section depends upon the motor type. All relevant information is outlined in chapter 4 "Technical data".

Note: The minimum cross-section provided also applies to the ground terminal and must be maintained.

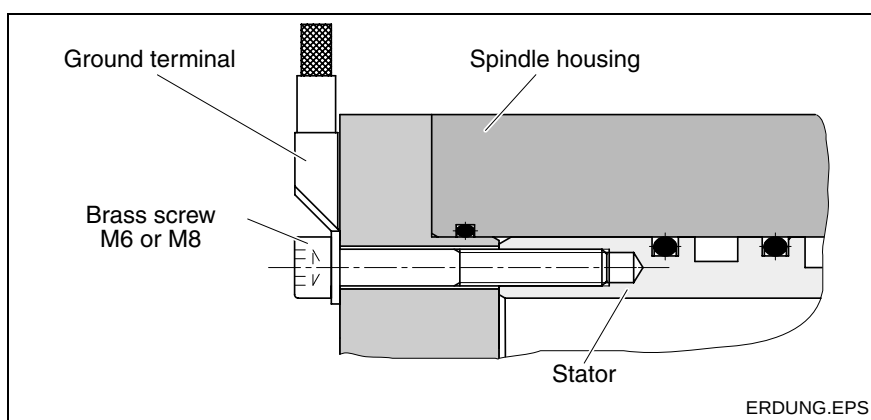


Fig. 11-22: Grounding the stator and spindle housing

- Proceed as follows:
- 1. Clean the mounting surface for the head of the screw. The metal surface must be spotless so that both the spindle housing and the stator are grounded.
 - 2. Screw the grounding cable with the terminal end to the end plate using a brass screw (M6 or M8, depending upon the model).
 - 3. Use Vaseline to lubricate the connection and protect it against corrosion.

Connecting the cable gland to the flange socket

The wires of the cable gland are soldered to the rear side of the flange socket.

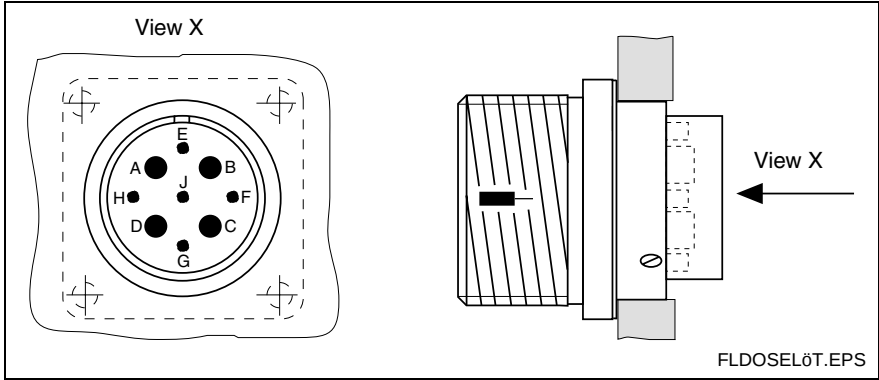


Fig. 11-23: Indramat flange socket IN 192/25 with contacts designated (soldered side)

The wires should be soldered as follows:

Designation of contact	connect to	
A		power terminal
B		
C		
D		ground cable
H		NTC thermistor connection
J		
E		Spare NTC thermistor is shorted to contact E
F,G		remains unused

APFLANSCHDOSE.EPS

Fig. 11-24: Connecting flange socket IN 192/25

Attaching cables in a terminal box

Prior to attaching the cable gland wires in the terminal box, check the seals of the terminal box:

- There must be a seal for both the terminal box and the lid (see Fig.11-25).
- Both seals and seal surfaces must be in a faultless condition.

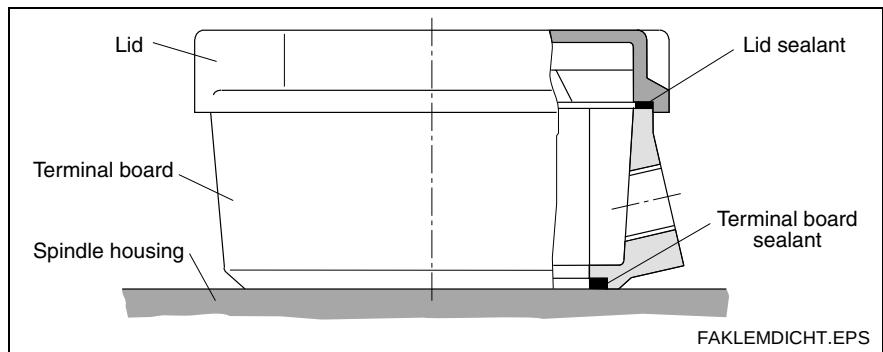


Fig. 11-25: Seals on the terminal box

If the cables are attached in a terminal box, both the cable connections and the ground terminals must be equipped with terminal ends. The size of the terminal ends must correspond to the cross-section of the conductors and the diameter of the studs in the terminal box.

Note: The individual wires of the cable glands must be clearly labeled in the terminal box so that the conductors are not confused.

Fig.11-27 illustrates an example of how to arrange the individual points of connection in a terminal box.

Attach the individual conductors as follows:

- Tighten the pinch fork terminal of the ground terminal at its intended point.
- Using a washer, fasten the power terminal to the terminal stud (note the tightening torques!). Connect them according to their designation:
 - conductor U to bolt U1
 - conductor V to bolt V1
 - conductor W to bolt W1

Thread	M3.5	M4	M5	M6	M8	M10	M12
Tightening torque, Nm	0.8	1.2	2	3	6	10	15.5

Fig. 11-26: Tightening torque for terminal board washers according to DIN 46200

- The NTC thermistor connections are clamped to the terminal strip.

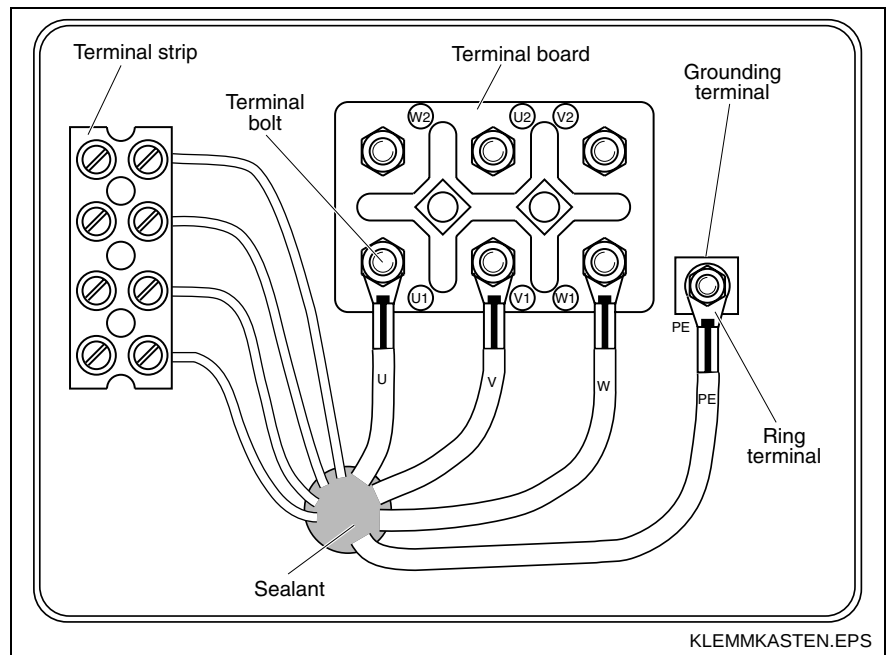


Fig. 11-27: Terminal box with terminal board and terminal strip

Note: If the terminal box design is different, the connections must be made according to the corresponding construction diagrams.

After connecting the conductor in the terminal box, use a plastic sealing compound to seal the through-hole between the terminal box and the spindle housing.

11.9 Electrical Check of the Motor Spindle

Running a High-Voltage Test

After installing the stator and connecting the wires in the terminal box or to the flange socket, it is necessary to run a high-voltage test.

This test is performed between the windings, housing and NTC thermistors and is meant to test the insulating properties.

The test voltage must be a sinusoidal alternating voltage $U_{\text{eff}} = 1500\text{V}$.

The test must be performed according to DIN VDE 0530, Part 1, Section 17.

Note: The high-voltage test must be carried out by a qualified electrician or under the supervision of a qualified electrician!

Test recommendations:

The following readings must be made and recorded in the test log (Fig.11-28):

- windings - housing
- windings - NTC thermistor 1
- windings - NTC thermistor 2

Proceed as follows:

1. The windings that are not to be tested must be connected to each other and to the housing.
2. Apply voltage $U_{\text{eff}} = 1500\text{ V}$ for five seconds to the relevant end of the winding or parts to be tested.
3. Measure the leakage current.

The test is successful if the leakage current is measured at $\leq 20\text{ mA}$ ($\leq 50\text{ mA}$ for 1MS 375).



Death by electrocution due to live parts!

- ⇒ If the leakage current exceeds the limit value indicated, the components are not sufficiently insulated from each other!
 - ⇒ During commissioning, there exists danger to life and limb upon contact with the spindle housing, as well as the risk of damaging the machinery!
 - ⇒ The frameless spindle motor must not be put into operation! Find and eliminate any faults.
-

Running an inductance test Once the entire motor spindle has been assembled – including the installation of either the terminal box or the flange socket – the inductance value of the spindle motor must be checked. The inductivity values are listed in the “Technical data” section of the corresponding 1MB motor.

- Test conditions:
 - Motor spindle temperature: approx. +20°C
 - Spindle is at a standstill
- Testing tools:
 - Inductance measuring device with a measuring frequency of 1kHz

- Test guidelines:

The reading will be made between the three power terminals or power contacts (see test log, Fig.11-28).

- reading of winding U – V
- reading of winding V – W
- reading of winding W – U

The values read may deviate max. $\pm 10\%$ from the inductance values listed in the technical data!

- Causes for deviating values:
 - the diameter of the rotor after dressing is not correct
 - the rotor is defective

Note: If the determined inductance value exceeds the range permitted, the characteristics curve of the drive can no longer be ensured! There is, however, no danger that the electrical drive components can be damaged during operation!

**Test log of the motor spindle
with a 1MB motor**

Motor spindle type designation:																							
Motor type: 1MB ____ - ____ - A ____ A _																							
Serial No.: 1MB ____ - _____																							
Date of manufacture: ____ - ____																							
(also see chapter "Identification")																							
• High-voltage test (acc. to section 1.8) <table border="1" style="width: 100%; margin-top: 10px;"> <tr> <td style="width: 50%; text-align: center;">yes</td> <td style="width: 50%; text-align: center;">no</td> </tr> <tr> <td style="height: 20px;"></td> <td style="height: 20px;"></td> </tr> </table> Tested acc. to procedure in section 1.8? Test voltage: _____ V Test duration: _____ V Measurement: U – housing V – housing W – housing NTC thermistor 1 – windings NTC thermistor 2 – windings <table border="1" style="width: 45%; text-align: center;"> <tr> <th colspan="2">Criterion: $i < \text{_____} ?$</th> </tr> <tr> <th style="width: 50%;">passed</th> <th style="width: 50%;">failed</th> </tr> <tr><td style="height: 20px;"></td><td style="height: 20px;"></td></tr> <tr><td style="height: 20px;"></td><td style="height: 20px;"></td></tr> <tr><td style="height: 20px;"></td><td style="height: 20px;"></td></tr> <tr><td style="height: 20px;"></td><td style="height: 20px;"></td></tr> <tr><td style="height: 20px;"></td><td style="height: 20px;"></td></tr> </table> Conductively connect the power wires of the cable gland!						yes	no			Criterion: $i < \text{_____} ?$		passed	failed										
yes	no																						
Criterion: $i < \text{_____} ?$																							
passed	failed																						
• Inductance test (acc. to section 1.8) Motor spindle temperature: _____ °C Meas. frequency: _____ kHz Inductance test acc. to Techn. data $L_{TD} = \text{_____} \text{ mH}$																							
Measurement				Test $0.9 \times L_{TD} < L_{\text{meas}} < 1.1 \times L_{TD}$ _____ mH < L_{meas} < _____ mH																			
Inductance of ...	Symbol	Unit	Meas. value	passed	failed																		
... U-V winding	L_{meas1}	mH																					
... U-V winding	L_{meas1}	mH																					
... U-V winding	L_{meas1}	mH																					
• NTC thermistor test and connection specification An NTC thermistor must be selected for connection to a control device and attached to the relevant terminals (see motor spindle connection diagram). Criterion: $30 \text{ k}\Omega < R_{20^\circ\text{C}} < 50 \text{ k}\Omega$ Remarks: _____ Location, date: _____ Name / Co.: _____																							

Fig. 11-28: Test log of the motor spindle

11.10 Removing the Stator from the Spindle Housing

The stator may have to be removed if, for example:

- a winding has burned out,
- both thermistors are defective,
- or the O-rings do not seal properly.



Electrocution due to live parts!

⇒ Before removing the stator, you absolutely must switch the power for the electrical system off and ensure that it cannot be accidentally switched on again!

Proceed as follows:

1. Detach the electrical connections:
 - Power connector
 - NTC thermistor connector
 - Grounding cable
2. Release the cylindrical pins on the end plate and remove them.
3. Using appropriate tools, slowly pull out the end plate.
4. Screw transportation rings into the appropriate holes.

Note: Avoid pulling or pushing the cable gland during removal to avoid damaging the stator!
The transport and handling regulations absolutely must be observed!

5. Using appropriate lifting equipment, slowly pull out the stator (caution: the stator is heavy!).

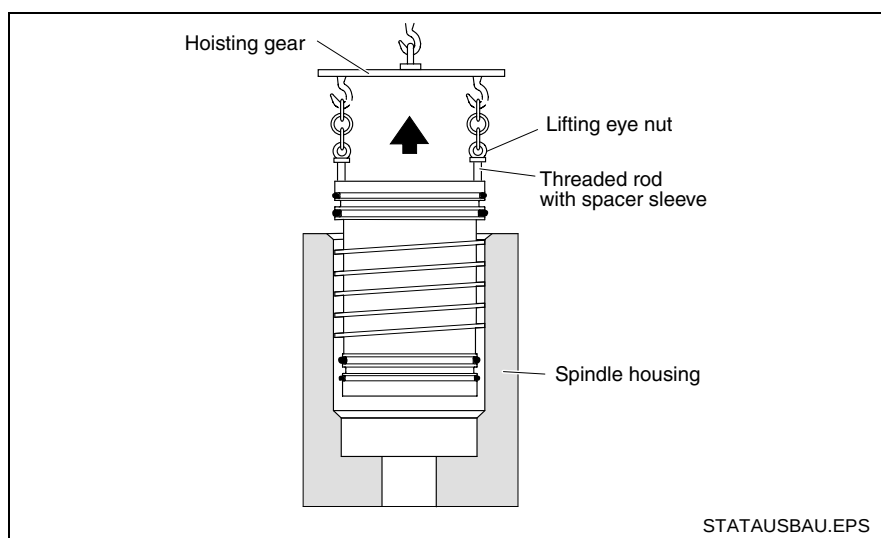


Fig. 11-29: Removing the stator from the spindle housing

12 Operating 1MB Assembly Kit Spindle Motors

12.1 Commissioning

Commissioning is carried out in the same way for all main spindle drives.

For this reason, and due to the large scope of the function, it is described only once in the BOSCH REXROTH documentation "AC main spindle drives with regulated asynchronous motors or assembly kit spindle motors: application description", Mat. Nr. R911268109, which is valid for all main spindle drives.

13 Service & Support

13.1 Helpdesk

Unser Kundendienst-Helpdesk im Hauptwerk Lohr am Main steht Ihnen mit Rat und Tat zur Seite. Sie erreichen uns

Our service helpdesk at our headquarters in Lohr am Main, Germany can assist you in all kinds of inquiries. Contact us

- telefonisch - by phone:
über Service Call Entry Center
- via Service Call Entry Center
49 (0) 9352 40 50 60
Mo-Fr 07:00-18:00
Mo-Fr 7:00 am - 6:00 pm
- per Fax - by fax: **+49 (0) 9352 40 49 41**
- per e-Mail - by e-mail: service.svc@boschrexroth.de

13.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

After helpdesk hours, contact our service department directly at

+49 (0) 171 333 88 26
oder - or **+49 (0) 172 660 04 06**

13.3 Internet

Unter www.boschrexroth.com finden Sie ergänzende Hinweise zu Service, Reparatur und Training sowie die **aktuellen** Adressen *) unserer auf den folgenden Seiten aufgeführten Vertriebs- und Servicebüros.

- ☐ Verkaufsniederlassungen
- ☐ Niederlassungen mit Kundendienst

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit unserem für Sie nächstgelegenen Ansprechpartner auf.

*) Die Angaben in der vorliegenden Dokumentation können seit Drucklegung überholt sein.

At www.boschrexroth.com you may find additional notes about service, repairs and training in the Internet, as well as the **actual** addresses *) of our sales- and service facilities figuring on the following pages.

- ☐ sales agencies
- ☐ offices providing service

Please contact our sales / service office in your area first.

*) Data in the present documentation may have become obsolete since printing.

13.4 Vor der Kontaktaufnahme... - Before contacting us...

Wir können Ihnen schnell und effizient helfen wenn Sie folgende Informationen bereithalten:

1. detaillierte Beschreibung der Störung und der Umstände.
2. Angaben auf dem Typenschild der betreffenden Produkte, insbesondere Typenschlüssel und Seriennummern.
3. Tel./Faxnummern und e-Mail-Adresse, unter denen Sie für Rückfragen zu erreichen sind.

For quick and efficient help, please have the following information ready:

1. Detailed description of the failure and circumstances.
2. Information on the type plate of the affected products, especially type codes and serial numbers.
3. Your phone/fax numbers and e-mail address, so we can contact you in case of questions.

13.5 Kundenbetreuungsstellen - Sales & Service Facilities

Deutschland – Germany

vom Ausland:

(0) nach Landeskennziffer weglassen!

from abroad:

don't dial (0) after country code!

Vertriebsgebiet Mitte Germany Centre	SERVICE	SERVICE	SERVICE
Rexroth Indramat GmbH Bgm.-Dr.-Nebel-Str. 2 / Postf. 1357 97816 Lohr am Main / 97803 Lohr Kompetenz-Zentrum Europa Tel.: +49 (0)9352 40-0 Fax: +49 (0)9352 40-4885	CALL ENTRY CENTER MO – FR von 07:00 - 18:00 Uhr from 7 am – 6 pm Tel. +49 (0) 9352 40 50 60 service.svc@boschrexroth.de	HOTLINE MO – FR von 17:00 - 07:00 Uhr from 5 pm - 7 am + SA / SO Tel.: +49 (0)172 660 04 06 oder / or Tel.: +49 (0)171 333 88 26	ERSATZTEILE / SPARES verlängerte Ansprechzeit - extended office time - ♦ nur an Werktagen - only on working days - ♦ von 07:00 - 18:00 Uhr - from 7 am - 6 pm - Tel. +49 (0) 9352 40 42 22
Vertriebsgebiet Süd Germany South	Vertriebsgebiet West Germany West	Gebiet Südwest Germany South-West	
Bosch Rexroth AG Landshuter Allee 8-10 80637 München Tel.: +49 (0)89 127 14-0 Fax: +49 (0)89 127 14-490	Bosch Rexroth AG Regionalzentrum West Borsigstrasse 15 40880 Ratingen Tel.: +49 (0)2102 409-0 Fax: +49 (0)2102 409-406 +49 (0)2102 409-430	Bosch Rexroth AG Service-Regionalzentrum Süd-West Siemensstr.1 70736 Fellbach Tel.: +49 (0)711 51046-0 Fax: +49 (0)711 51046-248	
Vertriebsgebiet Nord Germany North	Vertriebsgebiet Mitte Germany Centre	Vertriebsgebiet Ost Germany East	Vertriebsgebiet Ost Germany East
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